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American Dyestuff Reporter, Vol. XX, No. 14, July 20, 1931. Published Bi-Weekly by Howes Publishing Co., Inc., 440 Fourth Ave., New York, N. Y. Domestic subscription, $5.00; Canadian, $5.50; foreign, $6.00. Entered as second-class matter, Nov. 6, 1919, at the New York, N. Y., Post Office, under the Act of March 3, 1879.

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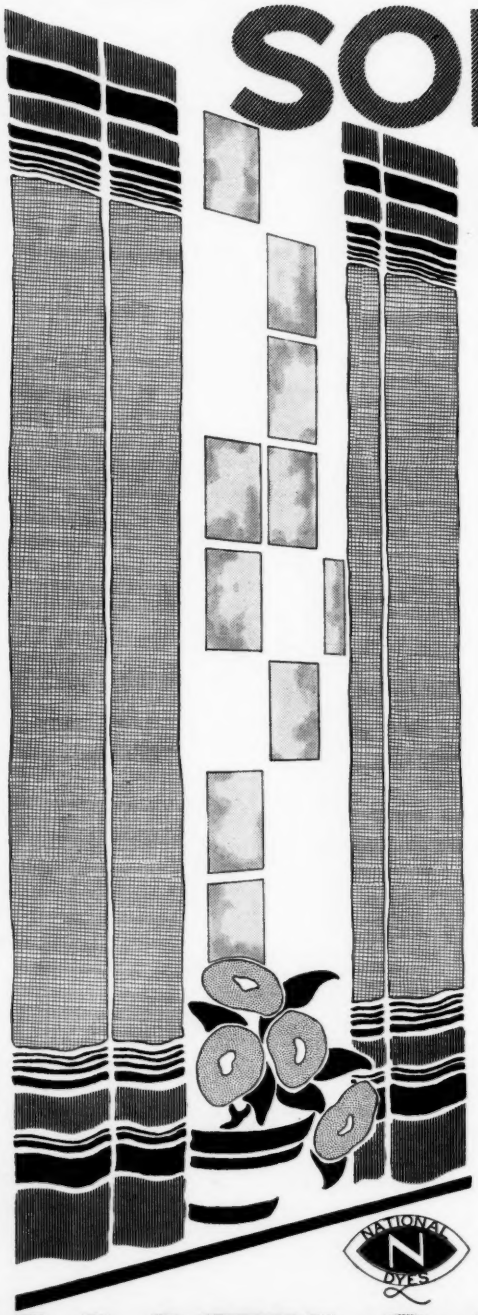

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VOLUME XX | JULY 20, 1931 | NUMBER 14

Simplified Technique for the Preparation of Stereoscopic Photomicrographs

By EDWARD R. SCHWARZ, S.B., A.T.I.

Ass't Professor of Textile Technology, Mass. Institute of Technology

In this article the preparation of stereoscopic photomicrographs is taken up in a clear and concise manner. The entire process is thoroughly reviewed with exactness given to technical details. The text is made clearer by photomicrographs illustrating the matter discussed by the author. Although the stereogram was once a luxury, it has now become a convenience to the textile technologist.

THE mill research man, whether chemist or physicist; whether concerned with powders and crystals, or fibers and fabrics, will find that the stereoscopic photomicrograph as a permanent record of a micro-observation is a very desirable adjunct to his files. Hitherto the difficulty and expense of preparation of such pictures has prevented their widespread use. Now, however, ordinarily available equipment or an inexpensive accessory or two is all that is required. While it is still possible, and often desirable, to use the binocular stereoscopic microscope for the work, it is no longer essential to have such an instrument at hand. Nor is it necessary to have a special camera of the sort supplied for use with the binocular stand.

Most manufacturers are providing their camera supports with a pivot so that the camera can be used in conjunction with the microscope in either the horizontal or the vertical position. For use with the binocular microscope a position part way between these two extremes is adopted. Set the microscope on the stand of the camera support, in such fashion that the axis of the camera can be made parallel with the ocular of the microscope. To do this, the microscope should be set at ninety degrees from its usual position. It is wise to place a heavy piece of cardboard on the base of the camera support, and to fasten it securely in place. Now, after the microscope is in position, lines should be drawn on the cardboard to indicate the placement of the microscope base. By drawing in a pair of diagonals lightly, the center of the base may be located. Now reverse the outline in a second drawing superimposed upon the first—in another color, if desired—so that the new line-up will be exactly 180 degrees from its original placing. This cardboard should be retained once the outlining is complete, and can be used over and over again.

Now assuming that the microscope is set up in the first position, place the specimen on the stage and illuminate it as desired. Usually oblique lighting from above the stage, and at approximately forty-five degrees with the direction of the most prominent ridges or surface irregularities will prove most satisfactory. Transmitted light will give inferior results, since the stereoscopic effect is concerned with the surface of the specimen and not its internal structure. Use of transmitted light is not ruled out, however, since it can often be employed to advantage in conjunction with reflected light to show additional internal structure. The internal details should always be subordinated to the external. Skill in lighting comes only with practice, and no hard and fast rules can safely be laid down. In each case, the proper rendition of shade and shadow to emphasize the feature which it is desired to bring out is required. The usual light-tight connector should be used to join the camera to the microscope. Certain models of the binocular instrument have oculars of small enough diameter so that the ordinary connector will fit in the usual way. Where the ocular diameter is too great for this, the connector may simply be placed to rest on the ocular, and will be held in position by the concentric rings of the camera section of the unit, provided care is taken not to jar the apparatus.

To obtain sufficiently intense illumination, a bull's eye condenser on an auxiliary stand which should be univer-

sally adjustable for both height and position, may be used. A source of light on the order of any of the so-called high power illuminants (400-500 Watt Mazda or carbon arc) will be satisfactory. Focussing is done as usual on the ground glass screen of the camera. The image will not be as brilliant as when working with transmitted light. The picture will always appear to better advantage than the projected image. With as intense an illumination as that mentioned above, there should be no difficulty in getting an image of sufficient brilliance for easy focussing. Because of the tendency to poor correction of the image at the edge of the field, a lens system of sufficient power should be employed to keep the portion of the specimen which it is desired to show in the middle of the field and occupying only the central third of the circular area, if possible. This will usually be easy to accomplish. If the light and set-up are correct, it will be seldom that the exposure with an ordinary orthochromatic plate will be more than thirty seconds. Experience is again the only sure guide here. While it is true that, as a rule for photomicrographic work, an overexposure is more to be desired than an underexposure; it is doubly to be sought in the case of the stereogram. Much more pleasing results will be obtained in the final mount when this is the case. This does not mean that the exposure should be excessive, and the negative hopelessly dense.

After the exposure has been decided upon and completed and the ground glass focussing screen has been replaced, the microscope is carefully turned through 180 degrees and placed so that it exactly fits the drawn-in outline for this position. Care should be taken that the specimen does not shift its position during this operation. If good spring clips are used on the stage, there will be little difficulty experienced in keeping the object in place. A slight alteration of the focus may now be necessary, but this will not interfere with the final result. Be sure that the image is centered in the space occupied by the plate, as it was before. Make the second exposure on a new plate of exactly the same length as the first. This time, of course, the picture is taken through the other ocular—because of the reversal of the microscope. Thus when the pictures are combined properly, the stereoscopic effect is produced. The pictures will not be identical, but frequently may be difficult to distinguish from each other. Make certain that the light has not been changed in its intensity, although the direction of the lighting may well be altered to a position 180 degrees from its previous alignment. Thus the shadows produced will be substantially unaltered.

At least one manufacturer supplies a binocular microscope so built that objectives and oculars are carried upon a swivelling head and may be rotated simultaneously. This arrangement, unfortunately, does not eliminate the necessity for turning the microscope as a whole before taking the second picture. A moment's thought will make evident the fact that rotation of the head alone, simply places another ocular and objective in exactly the same position as the first set. Thus no difference in the pictures obtained before and after the rotation will be found, and no stereoscopic effect can be produced.

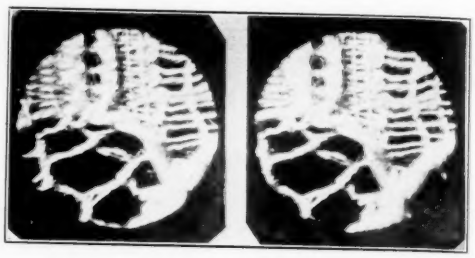

Figure 1
Stereogram of lace structure made through the ordinary microscope with tilting mount.

The negatives employed for taking the pictures should be marked so that they may be distinguished from each other. When mounted side by side on a cardboard backing of the correct size and shape to fit the usual stereoscope, the prints made from the negatives will stand out in three dimensions. It is essential that when they are mounted, they be in perfect register. The distance apart does not greatly matter. If the pictures are placed so that their centers are about 2½ inches apart there will be little trouble in adjusting the slide of the stereoscope to the best position. The simplest procedure for mounting is to fasten one picture temporarily in place with a drop of cement or paste. Place the other print at what is judged to be the correct distance from it. Orient it until it is closely parallel with the first, and on a horizontal line with it. Fasten this with a drop of mounting medium. Place the whole mount in a stereoscope and move one of them about until the pictures are seen to "fuse," and stand out sharply in three dimensions. Now outline each print in pencil and make a small index mark or two extending a slight amount into the print and showing on the cardboard as well. The pictures can now be removed, the backs coated with cement or paste, and replaced in perfect register. This procedure avoids the messy handling of sticky prints while orienting, and also does away with the chance for mussing up the mount as would most surely be the case otherwise.

In case the pictures can be made to "fuse" without difficulty but do not stand out in three dimensions, either of two things may be the matter—assuming that the taking of the pictures has been carried out correctly. Either both prints are from the same negative, which occasionally happens, or—what is more likely—they have been transposed. Should the former not be the case, all that is necessary is to reverse the placing of the prints on the mount. The right hand one should be on the left, and vice versa. It will now be necessary to re-orient the prints as before, and bring them into register.

A number of workers have successfully attempted to take stereoscopic pictures through the ordinary microscope. One method is to arrange the specimen so that the center of the field is about 1¼ inches from the center of the focussing screen. A photograph is taken as usual.

Now the specimen is moved on the stage—using only one adjustment of the mechanical stage, until the center of the specimen as seen on the focussing screen is just the same distance as before on the other side of the mid-point. A second picture is taken.

Another scheme employs a device which is placed between the objective and the end of the body tube of the microscope. The accessory contains an eccentric stop so that first one-half and then the other half of the objective may be put out of service. It has also been suggested that when a sliding nosepiece is used to carry the objective, it may be slid slightly out of position for the exposure of the second negative.

Still another possibility is to employ a diaphragm made in the form of a disk of the right diameter to slip into the ocular and to rest on the ocular diaphragm. The disk carries a small hole spaced to one side of the center. Provision is made by means of marks—or by adjustment of the ocular—so that it could be rotated exactly half a turn. One picture is made with the disk in the first position, and the second with the disk in the other. The size of the field is reduced, and the hole in the disk should not be so small as to cause poor definition in the image. More elaborate arrangements have also been constructed.

The author had occasion to make suggestions regarding a special mounting device put on the market recently by the Bausch and Lomb Optical Company for handling yarn and fabric in the textile and other microscopes. He saw no reason why the same device might not be arranged to serve for the preparation of stereograms as well. Essentially the mount is a base which fits the standard mechanical stage in place of the usual glass slide. It carries a double ring, which is so arranged that fabric or yarn, or a microscope slide may be held between its elements. The mount thus made can be rotated through 360 degrees, and is arranged to tilt through a five degree angle from the horizontal on either side of the axis. The fulcrums are so designed that the axis of tilt is very close to the plane occupied by the surface of the specimen to be examined. It is only necessary to center the mount and to tilt it, for example, to the right as the operator faces the front of the microscope stage. The first picture is taken as usual and, if care is used in the selection of oculars and objectives for depth of focus and size of field, the entire area which it is desired to show may be rendered sharply in focus. Where it is essential that an optical system of too high a power for this uniform sharpness of focus be used in order to obtain resolution and magnification of the requisite amount, a modification—or better—a compromise is possible. In the first picture, focus sharply on the parts of the specimen in the foreground. In the second exposure, focus rather more sharply on the portions in the background. The composite picture in the resulting stereogram, while not giving a perfect focus over the entire field, will still be much better than would be the case ordinarily. A striking example of this is the photographing of fungus spore heads. These usually project decidely from the fiber or other material upon which the mould is growing. To get both the head and the fiber in focus simultaneously with an objective of sufficient power to show the head to advantage is very difficult, if not impossible. Figure 2 of a fungus growth on silk filaments shows the use of this method. The left hand unit of the stereogram is focussed

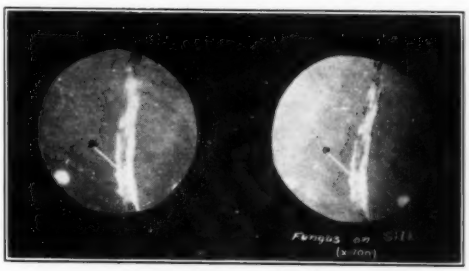

Figure 2
Stereogram of fungus on silk filament. Tilting mount.

on the spore head, and the silk is slightly blurred. The right hand member of the stereogram shows the filament sharply in focus and the spore head slightly blurred. When the mount is viewed stereoscopically, we get what appears to be perfect focus of both head and filament.

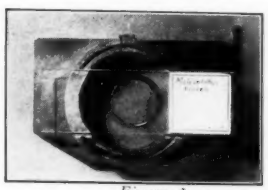

Figure 3
Top view of tilting mount showing micro slide in position (tilted to left).

Returning to the use of the special mount, the second picture is taken after the tilting ring has been tipped to the left. A slight alteration of focus may be called for in any case, and the fine adjustment of the microscope makes this possible. If the tilting of the mount has been slowly and carefully done, there should not be any decided shift of the specimen other than that caused by the normal action for stereoscopic reproduction. If a noticeable shift occurs, either the specimen has slippped slightly, or else the surface of the specimen is not in the same plane as the tilting axis.

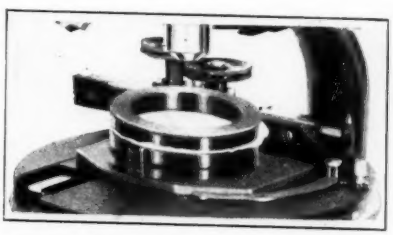

Figure 4
Tilting mount in place on microscope. (Courtesy Bausch and Lomb Optical Co.).

To avoid difficulty and uncertainty in mounting the prints to make the finished stereogram, the negatives should be marked in advance. One is labelled "R" and the other "L". This may be done when the plateholder is being loaded in the dark room. A regular photographer's marking pencil may be employed, or an ordinary lead pencil will serve. Make the mark in one corner of the film or plate on the emulsion side. In taking the pictures use the negative marked "R" when the mount is tilted to the RIGHT and the negative marked "L" when the mount

is titled to the LEFT. This is simple and easy to remember. When prints are made, the pictures will be automatically reversed as is necessary for stereoscopic viewing. The print from the "R" negative should be mounted on the right hand side of the stereogram and the print from the "L" negative should be mounted on the left hand side of the stereogram.

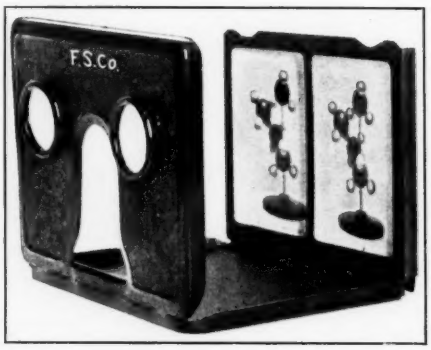

Figure 5
Stereoscope of simplified design. The instrument is collapsible for carrying.

With objectives of shorter focal length than the 32 mm. in use, the lighting of the specimen may be found difficult by ordinary means. The author has found that for objectives up to and including the 8 mm., that the "Silverman" illuminator gives excellent results. This is essentially an electric light bulb shaped like a partial torus, and arranged to clamp to the objective near its lower extremity. The light is thus directed by the silvered inside surface of the back of the bulb acting as a mirror onto the specimen from practically all directions. Where oblique, undirectional, illumination is desirable in order to obtain shadow effects, a small eccentric diaphragm is provided to cut off the light from the illuminator at the portion not needed. The resistance employed with the light is equipped with a button arranged for stepping up the voltage while the actual exposure of the negative is being made. The life of the bulb is prolonged by this means, while sufficient intensity of light is provided for easy photography.

For work with higher powers than have been mentioned in the foregoing, the use of dark ground illumination will prove of assistance. The tilting mount is not suited for this because it is too high above the plane of the stage to allow of the correct focussing of the condenser or the dark ground illuminator. It may however be used with ordinary oblique illumination. Nothing more of detail will be given here on the use of high powered objectives, since for stereoscopic work there is only infrequent occasion for the three dimensional view. The great majority of specimens will be essentially flat in order to be studied at all at such magnification and resolution.

The employment of mounted specimens introduces one or two difficulties which are not particularly serious, but which are annoying in the finished stereogram. If the cover glass is not perfectly clean on both sides, the particle or particles of dirt will photograph and when the stereogram is viewed later, they will appear to be suspended in the air in front of the specimen. It is of importance, therefore, to have the mount as perfect and as free from external dirt as possible. For high powers, foreign matter in the mounting medium itself presents the same trouble. The difficulty is not considered as serious, however, since the careful microscopist takes every precaution to keep the specimen and the finished mount scrupulously clean as a matter of ordinary routine. If he is not able to do this, he is incapable of the best work with the microscope. The fault lies with the operator and not with the technique we have been considering.

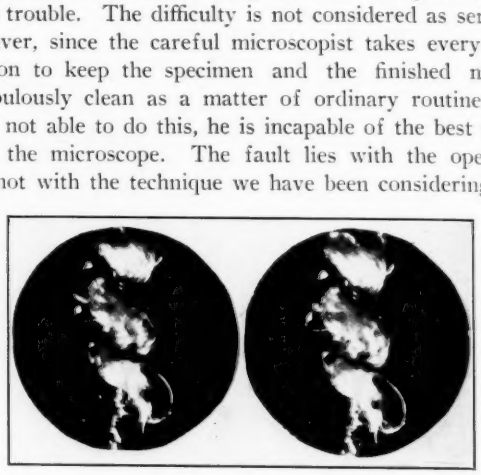

Figure 6
Stereogram of a novelty yarn. The reader may make this picture stand out in three dimensions by looking intently for a moment at a cloud or other distant object and then WITHOUT CHANGE OF EYE FOCUS at the figure above.

Any worker with lace structure, with lenos, with lappet and swivel weaves, with knit goods, with felts, and with many similar constructions will be well aware of the failure of the ordinary methods of study to reproduce the desired characteristics. While examination of

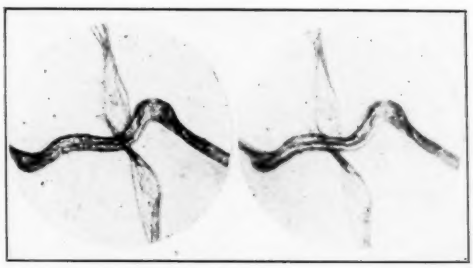

Figure 7
Stereogram of cotton fibres.

the specimen through the binocular stereoscopic microscope gives the worker a three-dimensional picture while he works, he has no way—short of a stereogram— to preserve the appearance of the specimen to show to someone else at a later date, or to file as a permanent record. In the study of any of the materials mentioned above, the third dimension is of vital consequence. The investigator is interested not only in the arrangement of the fibers and yarns in a single plane, but he is essentially concerned with their placement above and below each other, and their twisting and looping action. The study of stitch formation in knit goods is a most uncertain and unsatisfactory task with anything but a stereoscopic instrument. Records of observations are equally unsatisfactory unless they are or can be made stereoscopic.

In work of fundamental investigation of fiber properties, the nature of the fiber surface is of very considerable interest. Luster, frictional grip, dye absorption, moisture penetration and structural defects can best be studied when it can be shown whether or not the phenomenon observed has real depth or is only a surface marking, or an optical effect due to refraction, or diffraction of light. Successful stereograms have already been taken of diatoms, the nature of whose surfaces was under dispute. There is no reason why the surface of cotton fiber, wool fiber, rayon filaments, etc., cannot also be so studied. The importance of the stereogram in this connection is great.

With the development of a simple technique and with the ease and rapidity with which it can be carried through, there is little excuse for failure of the textile technologist to avail himself of what was once a luxury, but now a convenience, the stereogram in photomicrography.

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MORALS FOR THE TRADE IN THE CELANESE-SILKENESE CLASH

By WALDON FAWCETT

IT WOULD be trite, indeed, to remark on the problems and complications which have appeared in the textile field in consequence of the entry of rayon and the development of the resultant competitive conditions. It has remained, however, for a current test case in the U. S. Court of Customs and Patent Appeals to emphasize how very diverse are the sequels to latter-day inter-industrial rivalry. Here, behold evidence that even in the selection and protection of trade marks must there be due recognition of the proximity of different classes of fabrics when the latter are offered as alternatives for various uses.

The contest before the special reviewing authority at Washington was a legal duel between the Celanese Corporation of America and Vanity Fair Silk Mills. Following the regular course of disputes over trade mark possession, the clash of interest had previously been umpired by the tribunals at the U. S. Patent Office—the institution charged with the administration of the Federal trade mark laws. Dissatisfaction, on the part of one party, with the outcome, resulted in reference of the issue to the authority higher up. From the standpoint of the general enlightenment of the textile community on the very important basic principle involved, this appeal may be accounted fortunate since it brings to bear on one of the vital elements of textile identification policy, the judgment of a comparatively new super-censor of trade marks that has, during its brief history, shown exceptional solicitude for avoidance of all forms of confusion in trade.

Issue was joined in the instant case when Vanity Fair Silk Mills made application at the Department of Commerce for registration of the brand "Silkenese" as a trade mark for piece goods and for knitted and textile underwear. It was asserted that the owners had been using the mark "Silkenese" since March, 1927, and that, almost from the outset, sales of merchandise bearing the name in question constituted approximately 40 per cent of its total business. To the request for registration, the Celanese Corporation promptly offered "Opposition," the ground for the protest being that the last-mentioned corporation had, from a date long prior to the birth of "Silkenese," used the trade mark "Celanese" on threads, yarns, fabrics and garments. The Celanese Corporation, in support of its protest, collected evidence of direct competition between Celanese and Silkenese and brought details of instances of actual confusion to justify the assumption that the substitution of the junior product for the senior would cause injury to the producer of "Celanese" goods. Incidentally, there was a showing of about $1,000,000 expended in advertising Celanese, as against a parallel outlay of $15,000 for exploitation of Silkenese.

On a showing of essential similarities in the two trade marks, which seemed to overshadow the differences, the subordinate umpire at the U. S. Patent Office—the official acting as Examiner of Interference—had no difficulty in concluding that there was a likelihood of confusion and that the opposition of the Celanese Corporation should be sustained, thus barring the reminiscent rival. A contrary view was taken by the First Assistant Commissioner of Patents when the problem was passed up to him. While agreeing that the goods of the parties are the same he overruled his subordinate on the ground of lack of similarity in the marks. The head of the Patent Office was apparently swayed to a policy of non-interference by the fact that there have long been current in the textile industries and contiguous fields a variety of brand names ending in "ese" and including such examples as "Milanese," "Triconese," "Pomines," "Bernese" and "Vanise."

From the ultimate leniency at the Patent Office, the Celanese Corporation appealed to the special court which Congress established a few years ago specifically to supply a check on the soundness of the doctrines governing industrial-property rights promulgated at the Patent Office. In asking redress, the Celanese executives stressed the novelty and distinctiveness of the word "Celanese" which

was coined and adopted as early as 1922 to distinguish the acetyl cellulose silk originating with the British Cellulose & Chemical Manufacturing Company and the affiliated American Cellulose & Chemical Manufacturing Company. It was pointed out to what an extent "Celanese" had been used in commerce in conjunction with qualifying nicknames. As, for example, the use of "Celanese" in hyphenated combination with "Locknit" on knitted fabrics and in combination with "Ninon" for certain other types of fabrics.

Fortunately for the conclusiveness of its ultimatum, the Appeals bench analyzed very fully the practical and technical considerations involved in this legal tug-of-war. At the very outset the court revealed, by intimation, what is to be accounted one of the outstanding object lessons pointed by this case, viz., the growing prejudice in judical quarters against a later comer who, in a field so interlocked and interdependent as the textile industries, adopts a trade mark similar to the established mark of a pioneer in the field. The Court noted significantly, in its opinion, the circumstance that Vanity Fair Silk Mills had, in its earlier business career, used on its silk products the trade marks "Vanity Fair" and "Vanitysilk" and that it was not until the early part of 1927 that, with its entry upon the manufacture of artificial silk products, it adopted the name "Silkenese," albeit "Celanese" had, at that time, been extensively advertised and was generally known throughout the United States.

The outstanding moral, though, in this judicial appraisal is to be found in its exposition of a new trend of policy in trade mark review, viz: the disposition to weigh all cases of trade confusion or probable trade confusion not solely in terms of possible substitution of goods but, equally, in terms of the risks of confusion-of-reputation. Assaying "Celanese" and "Silkenese" the Court of Appeals noted that the respective lines of goods are so nearly alike in appearance and texture that if sold under similar trade marks, confusion would be likely to result. But, visibly, the Court was even more deeply impressed with the thought that the goods under "double" brands are sold in the same stores to the same class of people and that therefore the prestige of a well known name might be readily transmitted to a near-echo or shadowing designation.

Another moral which may be extracted from this pace-setting case is found in the substantial service of notice by the Appeals bench that the lay public must not be expected to split hairs when distinguishing between competitive trade marks. Repeatedly, of late, the business public has been admonished by the highest authority that everyday consumers cannot be counted upon to dissect composite trade marks but must be expected to gain and retain the impression of a trade mark in its entirety. Now comes the Appeals Court in this textile case and says in so many words that the public should not be required to analyze trade marks "with scrupulous care," nor, "should it be compelled to resort to a study of etymology in order to avoid confusion and mistake." On this finding that "Silkenese" and "Celanese" are "confusingly similar" the Court reversed the Patent Commissioner and said that Vanity Fair Silk Mills is not entitled to have its mark registered.

A final moral that obtrudes from this case points the futility of dependence upon textile industrial technicalities to establish an alibi for trade names that resemble veteran brands in sound or appearance. The representatives of Vanity Fair Silk Mills, in making their case, dealt impressively with the claim that Celanese differs both chemically and physically from other so-called rayons, asserting that since Celanese cannot be dyed with the same dyes as other rayons it would be possible for the fabric (unless differentiated in designation) to fall into the hands of a dyer who would not know how to handle cellulose acetate artificial silk. In short, the contention of the Vanity Fair people was that Celanese is a generic term, sifnifying to the dyer particular types of dye. But this view gained no sympathy in court.

Not unmeaningful, in its larger application, is the fact that the trade mark arbiters at Washington seemingly ignored, as inconsequential, the plea of Vanity Fair Silk Mills that "Celanese" has not had a trade mark use on garments, as distinguished from yarns and fabrics. The foundation for this futile attack had been found in the alleged circumstance that in earlier days the Celanese Corporation sold its yarns and fabrics on strict sales agreements instead of via the agency contract whereby a buyer is appointed agent for the affixing of Celanese labels to garments.

British Dyestuffs Production and Trade—1930

In the period from 1926 to 1929 the production of synthetic dyestuffs in the United Kingdom increased steadily from about thirty million pounds to nearly fifty-six million pounds. This annual increase was not maintained in 1930, however, figures just published by the British Board of Trade showing a drop of over 23 per cent from the high level of the preceding year. The 1930 total of 42,590,243 pounds was over 13,000,000 pounds below production for 1929, and more than 8,000,000 pounds below 1928. It was, however, higher than in other preceding years, and some 3,000,000 pounds above the 1927 output.

Since 1921 British dyemakers have been protected from foreign competition by the Dyestuffs (Import Regulation) Act which prohibits practically all competitive dye imports. This Act was due to expire at the end of 1930, but was extended to the end of 1931. Special import licenses are granted for non-competitive dyestuffs and for the past few years such imports (excluding intermediate products) have remained fairly constant at around 5,000,000 pounds annually. The growth of the British dyemaking industry under the protection of the Dyestuffs Act is indicated by the fact that imports in 1913 totaled 32,600,000 pounds, while domestic production was only about 9,000,000 pounds.

Liquid Sulphur Dioxide— The Antichlor

By **A. K. SCRIBNER**

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The well-defined properties of a suitable antichlor are discussed by the author. The available antichlors are listed according to their relative amounts of active ingredient. The method of applying sulphur dioxide as an antichlor in the liquid state is very carefully taken up. There is also included a discussion of actual plant practice.

THE chemical properties of pure 100%, liquid Sulphur Dioxide, combined with effective plant practice, are creating a constantly increasing demand for the use of SO_2 as an ideal antichlor in the bleach house.

Any material to be considered as an antichlor must have certain well-defined properties.

Primarily, the compound must remove all active chlorine and neutralize all free alkali quickly, economically, and safely, and it must be used in such concentrations that goods leaving the pit may be freed of the antichlor with almost no washing. These characteristics partially control the all-important problem of tendering or damage to fabrics while in process.

The secondary considerations involve the ability of the antichlor to penetrate to the chemicals in the seams and warp of heavy fabric, the maintenance of suitable concentrations by a simple, continuous feed, combined with freedom from trouble, if variations in flow are large, and, finally, the economies due to reductions in labor, wash water, and wear and tear on the goods.

Source of Cl and Alkali

The popular chlorine bleach today is based on a Sodium Hypochlorite solution that is made by the addition of chlorine to either a Soda Ash or Caustic bath, or a solution containing relative amounts of both Soda Ash and Caustic. The addition of chlorine to these alkaline solutions forms NaCl and NaOCl. The Sodium Hypochlorite (NaOCl) has the valuable bleaching property, while the salt (NaCl) does nothing. This means that only one-half the chlorine added to the alkali is available for active work. The usual formulae supply excess alkali, and this seems to run as high as a pound of Soda Ash for each pound of chlorine available for bleaching. Therefore, goods that have been steeped in chemic carry not only alkali that has come from the kier boil, but they carry additional alkali, as well as chlorine (NaOCl) from the chemic. These chemicals must be removed.

Available Antichlors or Sours

A number of compounds are available for use as an Antichlor or sour, but the best known are given in the table at the top of the next page.

This list includes "Liquid Sulphur Dioxide," a group of salts that all have SO_2 as their base and the two mineral acids that have been used for years. Each has definite inherent properties that should be understood if their relative values are to be appreciated.

Sulphur Dioxide, when dissolved in water, forms Sulphurous Acid (H_2SO_3). The strength of the acid depends upon the SO_2 concentration, with 11% SO_2 as a maximum. This solution of SO_2 has strong reducing properties which enable it to convert chlorine or Hypochlorite (HClO) into ordinary table salt (NaCl). As an acid, it neutralizes free alkali. The actual bleach house reduction and neutralization take place simultaneously, and require very dilute solutions—in fact, below .08% SO_2.

The salts carrying SO_2 are reducing agents, and will neutralize alkali, but they have certain disadvantages described later.

Mineral acids have been used for years, and are still popular in many bleach houses. The acids or "sours" actually free the goods of active chlorine by expelling it

AVAILABLE ANTICHLORS

	Trade Name	Chem. Symbol	Purity
Liquid Sulfur Dioxide	Esotoo	SO_2	100% SO_2
Anhydrous Sodium Bisulfite Powder	Metabisulfite	$Na_2S_2O_5$	64% SO_2
Sodium Bisulfite Solution	Liquid Bisulfite	$NaHSO_3$	21% SO_2
Sodium Thiosulfate	Hypo	$Na_2S_2O_3$	51% SO_2
Sulfuric Acid	Oil of Vitriol	H_2SO_4	93% H_2SO_4
Hydrochloric Acid	Muriatic Acid	HCl	35% HCl

into the air or create a high concentration of HOCl which is unstable and dangerous to the fiber in acid solution. The sour box acidity usually approaches ½% to 1%. This easily neutralizes all free alkali, but leaves excess acid on the goods.

PRACTICAL APPLICATION OF A SOUR

Let us now consider the individual sours and their use in the bleach house.

66° Sulphuric Acid, or oil of vitriol, is shipped in glass carboys or steel drums, and contains approximately 93.1% free Sulphuric Acid. The material is water-white, intensely corrosive on dilution, and should be handled with great care. The acid is always added to water to avoid a violent heat of solution and is usually diluted to 9° Tw. in lead-lined tanks before applying to the sour box. Even then, 9° Tw. material is given careful handling.

The 9° Tw. acid fed to the sour box creates a concentration of from 0.5% to 0.98% H_2SO_4 (0.5° to 1° Tw.) on the weight of the water in the box, and a continuous flow maintains the strength at this point. For weak chemic and a light bleach as low as .05% H_2SO_4 is used, but bleach house conditions control this. It is quite evident that if the liquor in the sour box contains from 0.5% to 1% H_2SO_4, the fabric leaving the pit is saturated with an acid of this strength. The goods are therefore given a complete and double washing after leaving the sour pit, and are inspected carefully for acid and free chlorine before proceeding to the dry cans. The passage over the can concentrates H_2SO_4 and Hypochlorites left on the fabric. Concentrated H_2SO_4 and hot Hypochlorites will tender cotton and affect the cellulose compounds. Sulphuric Acid does the work, but it requires careful attention, unusually large volumes of water, and added washings. One bleacher used to say: "Wash and wash again when using Oil of Vitriol."

There is no doubt that in many cases the H_2SO_4 sour increases the bleach, but this can be taken care of in the work preceding the sour box.

The chemical reaction of this sour may be written as follows:

$2NaOCl + H_2SO_4 = Na_2SO_4 + O + Cl_2 + H_2O.$

1 lb NaOCl + 1 lb NaOH = 0.70 lb 66° H_2SO_4 + 1.32 lb 66° H_2SO_4.

It is interesting to note that 2.02 pounds of 66° Acid will neutralize a pound of the Hypochlorite, and at the same time a pound of alkali.

22° Bé. Muriatic Acid, or a 35% solution of HCl in water, is shipped in carboys and should be water white and free from iron. This is another mineral acid, and, just as Sulphuric Acid, must be handled with care. It is used in somewhat different concentrations from Sulphuric Acid, but in order to free chlorine from the goods, and at the same time neutralize the alkali, the strength is at least twenty times that of SO_2. Tests have shown that HCl is difficult to wash out, so once more we have the problem of extensive washing to avoid tendering at the cans. When a bleach house is using Calcium Hypochlorite, instead of Sodium Hypochlorite, HCl forms soluble salts in the sour box, which can easily be washed off, while Sulphuric Acid forms insoluble Calcium Sulphate, which is very difficult to wash off, and may be left in the fibers of the goods. The reaction of Muriatic Acid is as follows:

$NaOCl + 2HCl = H_2O + Cl_2.$

$NaOH + HCl = NaCl + H_2O.$

From this it is evident that the theoretical quantities required are as follows:

1 lb NaOCl = 2.8 lb 22° Bé. Muriatic Acid.

1 lb NaOH = 2.5 lb 22° Bé. Muriatic Acid.

SALTS OF SO_2—AS ANTICHLOR

Of the SO_2 salts, the least used is perhaps "Hypo," or Sodium Thiosulphate ($Na_2S_2O_3$). The empirical formula indicates that it contains 51.6% SO_2 by weight, but when used as an Antichlor, the actual chlorine converted by the Sulphur Dioxide varies a great deal, and the reactions that actually take place have never been definitely proved.

Thiosulphate builds up salts in the liquor, and breaks down to give free sulphur, which is difficult to wash out, but it does neutralize the chlorine if used in sufficient quantity. "Hypo" must be carefully dissolved in the Antichlor pit to get maximum value.

Sodium Bisulphite Solution, another SO_2 carrier, contains a salt whose formula is $NaHSO_3$. The actual available Sulphur Dioxide is 21% by weight, and the solution has a Bé. of 33°. This antichlor has desirable properties, but is unstable, varies in Sulphur Dioxide content, and is expensive, due to the large quantities of liquid required to obtain small amounts of Sulphur Dioxide. It builds up salts in the sour box, and as the SO_2 is bonded, will not neutralize chlorine and alkali with the speed and

absolute end point of 100% SO_2. The chemical reaction is:

$$\begin{matrix}(NaOCl)\\(NaOH)\end{matrix} + NaHSO_3 = Na_2SO_4 + H_2O + NaCl.$$

Sodium Meta Bisulphite is a dry powder, shipped in sealed cans. This salt carries 64% available Sulphur Dioxide when freshly prepared, but it varies in stability and SO_2 concentration, and must be completely dissolved in the sour box in order to get in its full effect as a medium for reducing all chlorine (Cl_2 or NaOCl) and at the same time neutralizing the alkali. It, too, builds up undesirable salts in the sour box. Although an excellent SO_2 carrier, it is not as economical, easy to handle, and as absolute as 100% SO_2. The reaction on dissolving Sodium Meta Bisulphite in water is as follows:

$$Na_2S_2O_5 + H_2O = 2NaHSO_3.$$

Then the reactions proceed just as in the case of liquid Bisulphite, and the requirements become

$$\left.\begin{matrix}1\text{ lb NaOCl}\\0.54\text{ lb NaOH}\end{matrix}\right\} = 1.28\text{ lb } Na_2S_2O_5\text{, theoretically,}$$

or 1.33 lb of the Sodium Meta Bisulphite upon the market.

SO_2 as an Antichlor

Liquid Sulphur Dioxide is now used as an antichlor in order to furnish 100% SO_2 in the most convenient and economical manner. This material is a water-white liquid, 100% pure, and is shipped in steel cylinders that are easily handled. It never varies in purity, never decomposes in the container, and will go a long way in the bleach house. It is not harmful, and once a workman has used it, he appreciates the simple and safe way in which SO_2 does the Antichlor work.

The Liquid Sulphur Dioxide in the cylinder is under pressure, and slowly changes into gas when the valve on the container is opened. A comparison is water boiling on a stove. The steam represents the SO_2 vapor or gas. This gas can be bubbled directly into the antichlor pit to form Sulphurous Acid (H_2SO_3).

The gas mixes readily in water and is evenly distributed in the pit. When more than .08% has been added, the faint odor of SO_2 above the liquid advises one of the situation. No other antichlor or sour offers this practical method of controlling the concentration of the antichlor bath.

Pure SO_2 evaporated from liquid Sulphur Dioxide does not carry unnecessary salts into the antichlor bath, and, due to the constant overflow from the pit, foreign salts are maintained at a minimum. In fact, an SO_2 antichlor bath can be used for several successive days without decrease in efficiency.

In the bleachery, S_2 first forms H_2SO_3 when added to the water, and then reacts as follows:

$$H_2O + SO_2 = H_2SO_3 \text{ (Sulphurous Acid).}$$

$$H_2SO_3 + NaOCl + 2NaOH = Na_2SO_4 + {}_2H_2O + NaCl.$$

$$\left.\begin{matrix}1\text{ lb of NaOCl}\\\text{and}\\1.08\text{ lb of NaOH}\end{matrix}\right\} \text{— are handled by 0.86 lb of } SO_2.$$

The final products of this equation are Sodium Sulphate (Glauber's Salt) and sodium chloride (table salt). In the reaction some HCl and some H_2SO_4 are formed, but as alkalies are always present they immediately neutralize the acids—leaving the weak SO_2 water—of concentrations varying from 0.01% to .08%—on the fabric.

The extremely low concentrations necessary for the work and the fabric's ability to leave the antichlor pit in an almost neutral condition—free of active chlorine and alkali—is a specific property of SO_2. This avoids future tendering and is a contributing factor to the adoption of SO_2 as an antichlor.

When Calcium Hypochlorite has been used as the bleach, SO_2 or H_2SO_3 can be used safely because H_2SO_3 dissolves up all $CaSO_3$ formed and leaves no salts on the fiber.

Method of Applying Liquid Sulphur Dioxide

The addition of SO_2 gas to the antichlor pit from cylinders and the building up and maintenance of a definite concentration has been worked out in a practical manner. A cylinder containing liquid SO_2 is usually placed at each pit and the liquid is allowed to vaporize and pass through the cylinder valve and control apparatus directly into the bath. Only a few minutes are required to attain the initial SO_2 concentration which will average 0.025% by weight.

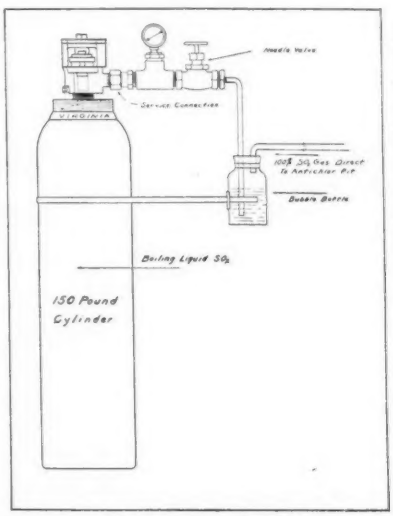

Figure I Control method

A combination gauge and bubble bottle has been developed which enables the practical bleach house attendant to visualize for himself the rate of flow throughout the run of goods. Figure (I) shows the cylinder, bubble bottle, hose and small connections. This comprises the entire equipment necessary to apply and successfully use SO_2 as an antichlor.

In starting a new run, the gas is bubbled quite rapidly into the pit until a faint odor of SO_2 appears over the liquid. At this point the operator reduces the flow to the speed that he has learned from experience will handle the goods on the line. A slight wash on heavy goods following a heavy chemic will require rapid bubbling in the guide bottle. When water is scarce, all washes might be light and then SO_2 does its maximum work, with a slight increase in its consumption.

As the liquid Esotoo boils, its temperature will gradually decrease and the flow of gas will slow down. The valve on the control line may be opened wider or else

the cylinder itself may be warmed, thus keeping the SO_2 in a boiling condition. If an unusually large flow of SO_2 is required, two cylinders both feeding SO_2 gas to the same pit will always give ample flow.

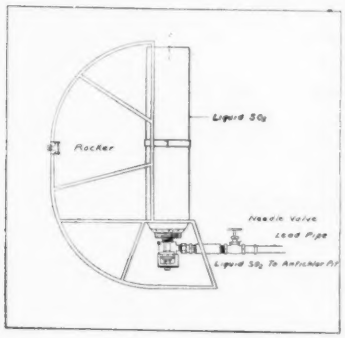

Figure II
Rocker for inverting cyls.

Sometimes liquid SO_2 is required and for this demand the cylinder is inverted, using a rocker as shown in Figure (II). The flow is controlled by a needle valve connected to the main valve of the container.

Estimation of Chemicals

Hydrometers cannot be used for accurately determining the SO_2 content of the Antichlor bath, due to the low concentrations prevailing. The following tables on the Specific Gravity at various concentrations may be of interest:

Per cent SO_2 by Wt.	°Tw.	°Bé.	Sp. Gr.
.1	.08	.07	1.0004
.2	.16	.14	1.0008
.3	.24	.21	1.0012
.5	.40	.36	1.002
1.0	.8	.72	1.004
1.5	1.2	1.09	1.007
4.0	4.2	3.07	1.021
10.0	10.2	7.46	1.05

Tenth Normal iodine is usually used to determine the actual amount of Sulphur Dioxide in the Antichlor pit. The method is as follows:

Draw a 50 c.c. sample of the liquid in the pit which is weak Sulphurous Acid (H_2SO_3). Add a few drops of starch solution, and then drop into this, with gentle stirring, N/10 iodine. A blue color will appear as soon as the iodine is added, and the addition of the iodine should be continued until this blue color disappears. This end point completes the titration.

1 c.c. of N/10 iodine = .007% SO_2.
2 c.c. of N/10 iodine = .014% SO_2.
3.8 c.c. of N/10 iodine = .025% SO_2.
5 c.c. of N/10 iodine = .035% SO_2.
10 c.c. of N/10 iodine = .07 % SO_2.

0.025% SO_2 by weight is the usual concentration for Antichlor work.

The real efficiency of an Antichlor, or a sour, depends upon whether the goods leaving the Antichlor pit contain any active chlorine as Cl_2 or NaOCl, and whether the goods contain any free alkali as NaOH or Na_2CO_3, or acid as H_2SO_4, HCl, H_2SO_3, or SO_2 salts. The best answer to the above depends upon a practical test for chlorine and acidity.

To determine the presence of active chlorine, drop five or ten drops of a starch iodide solution on the wet fabric. If the spots turn blue, free chlorine or NaOCl are present in the fabric.

For alkali, add a few drops of methyl orange solution to the cloth. If there is alkali present, the solution that has been added will stay yellow. If the goods are neutral or faintly acid, the methyl orange will turn pink. It should turn pink, a faint pink, thus indicating that the alkali on the goods has been completely neutralized.

These tests chemically control the efficiency of the Antichlor, and most workmen in the bleach houses have found that by combining these tests and the use of the bubble bottle described above, they can get the desired results with a minimum expense and trouble.

Plant Practice.

Bleacheries have found that the average concentration of the antichlor bath is between .02% and .05% SO_2, figured on the water in the pit. This, in itself, explains why a minimum wash is necessary when using SO_2 as an antichlor. Mineral acids will average 20 to 50 times the concentration just mentioned.

Plant practice will vary in each bleachery, and the practical man, once familiar with liquid Sulphur Dioxide, can rearrange his process as he thinks best. One or two bleacheries have installed small squeeze boxes before their strand washers following the chemic, and do their antichlor work at this point. They find that this combined antichlor and wash is very effective, and that if a trace of H_2SO_3 is left on the fabric, it will not tender the goods. The SO_2 on the fabric goes off into the air at the cans, and does not concentrate.

Thus

$$H_2SO_3 = H_2O + SO_2$$
Steam Vapor

Several other bleacheries have been able to save the wear and tear on their goods, etc., by coming from their white bins to a strand washer in which they bubble small concentrations of SO_2. They use this as their one and only antichlor pit. Others have been able to increase the strength of their chemic and produce a better white, because SO_2 gives them an absolute method of killing all chlorine.

Very often the process depends upon an additional bleach from the Sulphuric Acid sour after the chemic. Similar results can be obtained by using a little Sulphuric Acid before the chemic, or by increasing the amount of chemic used, followed by SO_2 as an antichlor.

If, however, a mill prefers to continue the use of Sulphuric Acid in order to obtain the additional amount of bleach, it is suggested that it reduces the amount of Sulphuric Acid, and only depend upon the acid for the oxygen bleach. Sulphur Dioxide can be added to the washer following the sour box and take care of excess chlorine on the goods. This combination offers the combined advantages of the mineral acid and an antichlor.

The following test is an interesting example of the affinity that SO_2 has for chlorine. Immerse a piece of fabric in 1° to 2° Tw. chemic for a minute or two, then

remove it. Squeeze tightly and dip in an 0.03% SO_2 Antichlor bath and again squeeze. After removal from the SO_2 bath, the fabric will usually give a negative test for active chlorine and free alkali.

Applied to plant practice, the bleacher will find that strong chemic of 2° Tw. or more on heavy fabrics will be easily "killed," even though the wash is very light before the antichlor.

The quantity of Sulphur Dioxide user per kier varies with the weight of the goods, the amount of chemic used, the amount of washing, and the operating speed, etc. The following figures are from plant runs:

Weight Yards per lb	Yards	Chemic	SO_2
1½	12,500	2°	14 lbs.
5¼	37,500	1¼°	2 lbs.
5	3,700	1¼°	3 lbs.

Practical tests, comparing the relative amounts of SO_2 and the other antichlors and sours necessary to "kill" chlorine and neutralize alkali, give the following ratios:

SO_2 vs. HCl—1 to 10.
SO_2 vs. H_2SO_4—1 to 8 and 1 to 15.
SO_2 vs. Bisulfite Liquid—1 to 10 and 20.
SO_2 vs. $Na_2S_2O_5$ Powder—1 to 2 and 3.

These ratios refer only to the chemicals used and do not include other advantages which one bleachery summarized as follows:

1 washer.
1 set squeeze rolls.
Wear and tear on goods.
$2.25 per day for labor.
Chemicals saved at antichlor pit.

Liquid Sulphur Dioxide's use as an antichlor is not limited to any particular field, and, due to the simple methods of application, experimental runs can successfully be made and used as a basis for continuous plant practice.

TEXTILE EXHIBITS CONVICT DESIGN PIRATES

By Waldon Fawcett

IF EDUCATION of the general public in color,—color values, color distinctions, and the power of color in sartorial and household decorative effects—is for the good of the dyestuffs industry, hail the latest "missionary" venture. Therein, the forces within the textile industries that are fighting design piracy, turn to the simplest of visual evidence. Evidence that will convince the average layman—the everyday ultimate consumer. Furthermore, this proof of the perils of piracy is to be brought to the textile-user's door by means of what is known as a "traveling exhibition."

In a measure, the whole underlying prinicple of this latest attack upon design raiding is a departure from previous effort to arouse adverse sentiment. Up to now, the major effort of the reformers has been directed primarily to the arousal of Congress and to efforts to persuade the national lawmakers to enact laws that will afford more elastic, more effective, and less expensive protection for original designs in industry. The fact that the last Congress failed to complete the job after having advanced a Design Copyright measure half way to the status of a law and the further fact that the entire project for relief must now start from scratch in a new Congress, has nurtured a suspicion among design evangelists that something more may be necessary to overcome Congressional inertia, if the design millenium is to be attained via Washington.

Out of this vision of a ground-swell of general sentiment or public opinion, insistent upon design integrity and applying pressure to Congress, has grown the educational program just unfolding, through the agency of a nomadic "rogues gallery" of counterfeit designs. It is assumed that the touring show of masquerading designs will not be without its contacts with Congressmen, as it visits leading cities in succession. But the chief ambition is to acquaint the main stream of humanity, generally unconscious of the ills of guerilla competition, with the nature and the extent of design piracy. Incident to that, and quite indirectly, in most instances, may come that elevation of public taste and sharpening of discrimination which is counted upon to beget a more intelligent appreciation of color as well as form in textile design.

The traveling exhibition, which arrays in damning parallel, original designs and cheapened, pirated imitations, is on tour under the joint auspices of the League for the Suppression of Design Piracy and the Art Center of New York. The project is part of the new campaign for design legislation which is to be staged forthwith to pave the way for reconsideration of the Vestal Bill in the 72nd Congress which is due to assemble in December. Inspiration for this parade, in pairs, of original and stolen designs came from the success of the American Federation of Arts in serving an art educational purpose by means of traveling exhibitions.

Material for the portable gallery of designs ruined by raiders was ready to the hands of the propagandists. The selection of original designs coupled with sinful doubles was made up last winter to illuminate the piracy predicament for Congressmen at the time that the Vestal Bill, bearing the O.K. of the House of Representatives, was before the Senate Committee on Patents. The collection was on show in the office of Senator Waterman, Chairman of the Senate Committee, for some six weeks. Then came a showing of the same material at the Art Center in New York. The reaction of interest on the part of the general public at that showing suggested to the sponsors the possibility of literally bringing home to the rank and file of the population throughout the country the consequences of piracy practices that usually result in the abandonment by the originators of designs pirated in lower-grade fabrics.

While textiles, and, notably, high-grade silks, make up the larger proportion of the scores of items in the traveling exhibit, the show is not exclusively of textiles. Indeed, all of the ninety trade associations which have cooperated in the work of the League for the Suppression

of Design Piracy were asked to contribute specimens and thus the array of pirated designs includes copied examples of wall paper, furniture, toys, laces, embroideries, etc. The textile thefts—copies by the photographic process—constitute the high lights of the exhibition and there are specimens which reveal more clearly for the layman than any amount of prosy description, how the slight differences in textile patterns, intended to supply a design alibi, are nullified, in effect, by color duplication. Indeed the show as a whole, properly interpreted to the general group of consumers, is an education in color in textiles as well as in the aggregated aspects of design.

Circulation of the Piracy Exhibit will be facilitated in proportion to the success of the movement to establish a working fund for the League for the Suppression of Design Piracy. The Art Center has the organization machinery for making contact with the institutions where the exhibit may most advantageously be placed on display. The first choice of a show place in each city is the city museum or leading local art gallery. A welcome is pretty well assured at such institutions because most of the museums and many public libraries are endeavoring to maintain continuous schedules of special exhibitions and are dependent more or less upon traveling collections to fill their dates. Where museum or other institutional space is not available, the piracy exhibit may go to leading department stores that are willing to feature it. A stay of not more than two weeks is contemplated for each city visited and the fact that the exhibits are in place on portable mounts renders it possible to quickly arrange the lay-out upon arrival at a place of exhibition and as quickly pack up the panels for shipment.

The traveling exhibitions of the American Federation of Arts, which have encompassed ceramics and certain classes of textile products as well as loan collections of paintings and sculpture, have attained the highest measure of success through enlistment of the interest of school children who have visited the traveling exhibitions in groups or classes and listened to lectures on the subjects covered by the exhibitions. It has been suggested that the same method of enlightening the rising generation might be employed for the piracy exhibit and delegations of visitors recruited not only from the public schools but likewise from girls' preparatory and finishing schools, the pupils of which might be especially susceptible to the fashion factor in design piracy.

Apropos the mention of the importance of nursing, in the schools, proper respect for original designs, it is worth noting that during the past year or two the art schools, public and private, throughout the country have suddenly developed an antagonism to design piracy that is in marked contrast to the lethargy which existed in this quarter theretofore. The explanation lies in the fact that many of the art schools, particularly the commercial art schools, are now undertaking to dispose of the work of pupils or to actively assist the pupils in placing their designs. In this relationship the art schools and their pupils are experiencing the pangs of their own version of design piracy—viz., the practices of unscrupulous concerns which invite the submission on approval of free-lance designs and ultimately return the offerings as unavailable, only to have the artists disillusioned in due course by discovery that their designs have been stolen outright or the dominant motifs lifted in the interim. This species of poaching and the alternative maneuver of offering a ridiculously low price for an entire collection of designs on the false pretense that only a few of the designs will be used, has stirred in the student body a resentment against design piracy in all its phases that should eventually make itself felt in Congress.

NEW PATENTS

4'-Sulpho-2-Benzoyl-5-Nitro-Benzoic Acid and Process for Making Same.—(Dyestuff intermediate which comprises reacting a solution of 4'-sulpho-o-benzoyl-benzoic acid, described in co-pending application Serial No. 203,265, filed July 2, 1927, in concentrated sulphuric acid with a nitrating agent.) Ivan Gubelmann, Henry J. Weiland, and Otto Stallmann, of So. Milwaukee, Wis., assignors, by mesne assignments, to Newport Chemical Corp., No. 1,810,008, June 16, 1931.

4-Sulpho-2-Benzoyl-5-Amino-Benzoic Acid. — (Dyestuff intermediate which comprises reducing 4'-sulpho-2-benzoyl-5-nitrobenzoic acid, described and claimed in co-pending application Serial No. 203,259, filed July 2, 1927, being above Patent No. 1,810,008.) Ivan Gubelmann, Henry J. Weiland and Otto Stallmann, of So. Milwaukee, Wis., assignors, by mesne assignments, to Newport Chemical Corp., No. 1,810,009, June 16, 1931.

2-Nitro-Anthraquinone-7-Sulpho-Acid and Process for Making the Same.—(Comprises treating 4'-sulpho-2-benzoyl-5-nitro-benzoic acid with oleum as dehydrating agent, diluting up the "ring-closing" mass with water and filtering.) Ivan Gubelmann, Henry J. Weiland and Otto Stallmann, of So. Milwaukee, Wis., assignors, by mesne assignments, to Newport Chemical Corp., No. 1,810,010, June 16, 1931.

Process of Preparing 4'-Sulpho-O-Benzoyl-Benzoic Acid.—(Dyestuff intermediate which comprises reacting a mixture of 4'-mercapto-o-benzoyl-benzoic acid and its corresponding disulphide with an oxidizing agent.) Ivan Gubelmann, Henry J. Weiland and Otto Stallmann, of So. Milwaukee, Wis., assignors, by mesne assignments, to Newport Chemical Corp., No. 1,810,013, June 16, 1931.

New Azo Dystuffs.—(Obtainable by reacting with a suitable arylamid of 2.3-hydroxynaphthoic acid upon a suitable diazotized amino-azo-compound obtained by coupling an o-hydroxy-diazo compound with an aromatic amine which is capable of further diazotization. Dye the fiber strong violet-black to greenish-black shades, the fastness properties being improved by after-treatment with suitable metal salts.) Josef Haller, of Wiesdorf-on-the Rhine, Ger., assignor to General Aniline Wks., Inc., of New York, N. Y., No. 1,810,273, June 16, 1931.

Proceedings of the American Association of Textile Chemists and Colorists

The American Association of Textile Chemists and Colorists

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Oriental Silk Printing Co., Paterson, N. J.

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Lowell Textile Junior Section—
Alfred J. Carbone, Chairman; Paul Duggan, Secretary.

North Carolina State College Junior Section—
R. A. Gilliam, Chairman; D. B. Hardin, Secretary.

CALENDAR OF COMING EVENTS

Annual Meeting
December 4, 5—Boston.

* * *

SEVENTY-FOURTH COUNCIL MEETING

THE Seventy-Fourth Council Meeting of the American Association of Textile Chemists and Colorists was held at the Engineers' Club, Boston, Mass., Friday, May 15, 1931, at 1:45 P. M.

The following were present:
President—P. J. Wood.
Vice-President—Wm. H. Cady.
Treasurer—H. R. Davies.
Councillors—Hugh Christison, Wm. R. Moorhouse, George A. Moran, Walter M. Scott.

Councillors ex-officio—Henry D. Grimes, Chairman, N. E. E. Section; Dr. D. H. Powers, Chairman, R. I. Section; Dr. Carl Z. Draves, representing C. A. Seibert, Chairman, Philadelphia Section; Prof. L. A. Olney, Chairman, Research Committee.

Secretary—Alex. Morrison.

Letters expressing regrets at inability to be present were read from Vice-President H. A. Barnes; Chairman R. S. Wheeler of the South Central Section; Chairman C. A. Seibert, Chairman of Philadelphia Section, the latter appointing Dr. Carl Z. Draves his representative.

The Secretary's report of the last meeting was read and approved.

The Secretary's balance sheet was read as follows and approved:

Secretary's Balance Sheet—May 13, 1931

Cash on Hand April 15, 1931	$146.16
Receipts April 15 to May 13. 1931, Incl.:	
Applications 14 at $5.00	70.00
Dues 1931, 103 at $5.00	515.00
Dues, Corporate	100.00
Year Book Sales, 2 at $3.00	6.00
Howes Publishing Co.—Reporters	1.50
Misc. Reporter Sales	.50
Atlas Electric Devices Co., Launderometer Royalty	11.00
	$850.16
Disbursements:	
May 5, 1931, Exchange Charge	$.25
Cash on Hand, Andover National Bank	839.91
Cash on Hand	10.00
	$850.16

The Treasurer's report was read as follows and approved:

Treasurer's Report—May 14, 1931

GENERAL FUND

Balance as reported April 17, 1931	$7,113.02	
Interest on Checking Account—First Nat. Bank	16.21	
Check returned by Kendall & Co.	3.00	
	$7,132.23	
Expenditures since April 17, 1931	236.35	
		$6,895.88

RESEARCH FUND

Balance as reported April 17, 1931	$5,282.75	
Expenditures since April 17, 1931	769.44	
Balance	$4,513.31	$4,513.31
		$11,409.19

Savings Bank Account First Nat. Bank	$3,727.98
Checking Account, First Nat. Bank	7,681.21
	$11,409.19

The following were elected to member as of thirty days after publication of their names, provided no objection is received by the Secretary:

ACTIVE:

Best, G. H.—6601A Blakemore St., Philadelphia, Pa. Sales Engineer, Procter & Gamble Dist. Co., Philadelphia, Pa.

Buckley, Harry—401 Morton Ave., Ridley Park, Pa. Sales Dept., Aberfoyle Mfg. Co., 123 So. Broad St., Philadelphia, Pa.

Caron, J. Hector—575 South 3rd St., Rochelle, Ill. Top Dyer, Morgan Dyeing & Bleaching Co., Rochelle, Ill.

Faust, Harold P.—P. O. Box 969, Greensboro, N. C. Office Manager, Ciba Company, Greensboro, N. C.

Gee, Robert N.—Arkwright, R. I. Supt., Interlaken Mills, Arkwright, R. I.

Herr, George D.—14 Memorial Ave., Saylesville, R. I. Dept. Supt., Sayles Finishing Plants, Saylesville, R. I.

Holterhoff, Hans A.—1013 W. Lehigh Ave., Philadelphia, Pa. Textile Chemist, Stead & Miller Co. Dyehouse, 1126 Bodine St., Philadelphia, Pa.

Kremers, G. R.—2502 71st St., Kenosha, Wis. Chemist, Allen A Co., Kenosha, Wis.

Latham, William E.—Y. M. C. A. Asst. Dyer, Aberfoyle Mfg. Co., Chester, Pa.

Petty, John—311 East Ridley Ave., Ridley Park, Pa. Dyer, Aberfoyle Mfg. Co., Chester, Pa.

Pfieffer, Howard J.—Plaza Hotel, Chicago, Ill. Demonstrating Salesman, John Campbell & Co., Chicago, Ill.

Reddish, W. T.—3043 Daytona Ave., Cincinnati, Ohio. Chemical Engineer, The Twitchell Process Co., Cincinnati, Ohio.

Shuptine, H. O.—4711 Brainerd Rd., Chattanooga, Tenn. Southern Representative, Celanese Corp. of America, 819 Johnston Bldg., Charlotte, N. C.

JUNIOR:

Cornwall, Barry V.—229 W. 14th St., Wilmington, Del. Colorist, DuPont Co., Technical Laboratory, Wilmington, Del.

Decnyf, George R.—103 Broadway, E. Paterson, N. J. Student, Philadelphia Textile School, Philadelphia, Pa.

Faulkenberry, Grady E.—358 No. Kerr St., Concord, N. C. Chemist, Cannon Mill No. 6, Concord, N. C.

Haar, Jurgen, Jr.—2412 Everette Ave., Raleigh, N. C. Student, North Carolina State College, Raleigh, N. C.

Roth, Milton—1464 Brook Ave., New York, N. Y. Textile Chemist, General Dyestuff Corp., 230 Fifth Ave., New York, N. Y.

Ryberg, Bertil A.—274 Appleton St., Lowell, Mass. Research Associate, A.A.T.C.C., Lowell Textile Institute, Lowell, Mass.

Topjian, Leon—14 Park St., Rockville, Conn. Asst. Chemist, Hockanum Mills Co., Rockville, Conn.

ASSOCIATE:

Chandler, C. F.—8374 Talbot St., Kew Gardens, N. Y. Chief Sales Service, DuPont Rayon Co., 2 Park Ave., New York, N. Y.

Clifford, A. Chester—47 Elm St., Elizabeth, N. J. Textile Engineer, Western Electric Co., 100 Central Ave., Kearny, N. J.

Oliver, F. M.—315 East 40th St., Savannah, Ga. Salesman, Textile & Tanners Dept., J. B. Ford Sales Co., Wyandotte, Mich.

Vliet, Edward Port—155 Lincoln Ave., Clifton, N. J. Treasurer, Frank-Vliet Co., Inc., 160 Water St., New York, N. Y.

CORPORATE:

Ciba Company, 627 Greenwich St., New York, N. Y.

A list of 115 members who had not paid their 1931 dues was presented by the Secretary and it was voted that they be dropped in accordance with the Constitution. The Secretary was instructed to refer the list of the dropped in each section to the Local Chairmen and Secretaries that they might get in touch with as many as possible, to see if any could be induced to pay their dues and become reinstated.

In connection with a vote taken at the last meeting to instruct the Atlas Electric Devices Company to use

copper tanks on all future Launderometers, it was further voted to allow them to sell the three machines in stock equipped with galvanized iron tanks as is, and to use the copper tanks on all others.

The tentative schedule for Annual Meeting reported at the Council Meeting of March 20, 1931, was next considered. It was voted that this tentative schedule be abandoned and it was further voted that the Council accept the invitation of the Piedmont Section to hold the 1932 Annual Meeting as their guests. The place of this meeting will be later decided by the Piedmont Section.

It was voted that the Council and Research Committee hold meetings in Washington, D. C., or further south, twice a year for the benefit of southern members who naturally find it difficult to come to New York or Boston.

Dr. Walter M. Scott, Chairman of the Technical Program for the 1931 Annual Meeting outlined progress being made by his committee, and the Council assure the members that an exceptionally fine program is in store for them.

The meeting adjourned at 3:15 P. M.

Respectfully submitted,

ALEX. MORRISON,
Secretary.

Correction

In answer to Mr. Herrmann's question on page (240) 408 of the Proceedings in the June 22nd issue which read as follows: There seems to be a lot of interest in finishes. I will ask one: I see a lot of delustered rayon. Does anyone know how it is being done? Is there such a thing as a finish which might be considered satisfactory that can be applied in the nature of a finish after dyeing, a finish that would be under control as to the amount of lustre that it leaves and that would stand a reasonable amount of washing and handling?

Dr. Coleman's answer to this question should have been as follows: Mr. Herrmann, your question was about delustering applied in finishing. After the goods have been finished there isn't such a thing as permanent delustering. After the first, second or third washing the dull effect disappears. Of course the whole principle consists of precipitating barium sulphate by the two-bath method. As far as I know I haven't seen any product which produces a permanent deluster. The most effective method of delustering is done in the finish.

Following Mr. Herrmann's next statement Dr. Coleman's answer should have been: It depends on the pigment you use. Another principle consists of using a pigment or colloidal earth.

In answer to Mr. Barbour's question on page (241) 409, which was as follows: Will caustic soda remove any kind of sizing?, Dr. Coleman's answer should have been: I don't know very much about the action of caustic soda on rayon but it is done. Rayon crepe dyers use caustic soda. They use a cold caustic soda solution. They pass the goods through it for about ten or fifteen minutes cold. It is usually done before the goods are desized. They claim that it produces a certain effect that they are after. Another thing, it softens the rayon, too. Of course it can be overdone. You should either use a weak solution at a high temperature or up to eight degrees Baumé cold. Some claim also that it delusters but I haven't seen that. They have treated rayon crepe at different temperatures and different strengths and they claimed the fiber actually changed in the caustic soda. I haven't seen it. Practically every rayon crepe dyer is using caustic soda solution. Some of them pass the goods through a caustic soda solution and wash the goods afterwards to remove the excess of alkali. Others wash the goods once and add enough acid to neutralize the soda. Some wash it once or twice and dye the goods afterwards with some of the caustic soda left. They claim it causes level dyeing.

On page (244) 412 Dr. Coleman's statement should read as follows:

I would like to add that it has been proven that caustic potash is better than caustic sodium, in fact, a much weaker solution is required than sodium. I know of cases where caustic potash is used. The sizes consist mainly of starch, glue and oil. The caustic soda kind of loosens up the size by attacking the starch, making the starch partly soluble, the glue being removed in the subsequent process of boiling off. The boiling is done mainly with soda and soap, or oil. The oil is emulsified in the boiling off. There is a question of the caustic soda producing a sort of swelling effect on the fiber. I know of cases where the goods are boiled off first and then after-treated with caustic.

COMMUNICATION

July 3, 1931.

Editor AMERICAN DYESTUFF REPORTER:

Since the publication of the last report of the subcommittee on Fastness to Light ("Classification of the Fastness of Dyed Textiles in the Standard Sunlight Test," AMERICAN DYESTUFF REPORTER, June 8, 1931) the committee has received complaints from several dye manufacturers because so few of their products were included among the dyes listed in this report.

In the first place, the committee wishes it distinctly understood that the dyes used in these exposures represent only types, not manufacturers. The purpose of the committee was to expose simultaneously as many as possible of the representative dyes in current use, in order to determine their relative fastness to sunlight. Whether any particular dye was manufactured by Smith or Jones or Robinson was of no consequence, as long as it was a standard brand, and our only reason for publishing the

manufacturers' names was to assist in identifying the different types.

In the second place, the committee believes that the data given in this report should be of considerable value even to those manufacturers whose products are not specifically mentioned by name. A firm manufacturing a product corresponding with Diamine Fast Red F, for example, may be reasonably sure that the classifications assigned to dyeings of Diamine Fast Red F will apply equally well to dyeings of his product, if the strength and purity are the same.

The committee invites criticism of this report, both constructive and destructive. The classification work has been done with a great deal of care; it is based on actual sun exposures of dyed samples prepared for this specific purpose, and represents the best judgment of all the members of the committee. If exceptions are taken to certain individual classifications because they seem abnormal, we can only state that in an undertaking of this magnitude mistakes are bound to occur, particularly when the dyeings are made in many different laboratories. We request all those who are dissatisfied to register their complaints with the committee, in order that any glaring errors may be speedily corrected.

WILLIAM H. CADY,
Chairman, Sub-Committee on Fastness to Light.

ASSOCIATION BADGES

The lapel button badge illustrated herewith is worn by members of the American Association of Textile Chemists and Colorists.

The three "rings" are enameled in red, yellow and blue, respectively, and the initials and border are brought out in gold. The general effect is exceedingly attractive.

Badges may be secured at $1.50 each by addressing the Secretary.

ALEX. MORRISON,
American Woolen Co.,
Andover, Mass.

AMERICAN DYESTUFF REPORTER

Devoted to the use and application of dyestuffs and the mechanical equipment incidental thereto.

LOUIS A. OLNEY
Professor of Chemistry and Dyeing, Lowell Textile Institute
Directing Editor

NORMAN ALBIN JOHNSON
Managing Editor

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Published biweekly by
HOWES PUBLISHING CO., INC.
440 Fourth Avenue, New York City

A. P. HOWES, President — M. D. REESER, Secretary — H. F. CRAWFORD, Treasurer

Subscription price $5.00 per year; Canadian $5.50; foreign $6.00

Vol. XX July 20, 1931 No. 14

STANDARDIZATION

ONE of the most recent tendencies in all industrial activities seems to be toward standardization. This includes standardization in nomenclature, price, manufacture, and methods of procedure and testing in experimental work.

This tendency in experimental work is the natural outcome of a long period of time in which investigators all worked along different lines of procedure and recorded their results in different manners. Separate workers on the same subject would have conflicting results due to the fact that they had no standard method or practice which they could follow. In any new work such conditions are probably necessary as there is no set method, established by precedent, to follow. In routine work, however, some definite method should be adopted by all experimentors in order that their results may be comparative. Even in new work the line of attack should be very nearly the same in all cases, as it would be based on a number of previous investigations of a similar nature. It is the ingenuity and initiative of the individual worker that makes it possible for him to adapt suitably standard methods to new work. To get acceptable results it is necessary for two independent workers to use the same procedure. For example, in dye testing, a dye, when compared to one standard, may have "good" fastness and when compared to another may have only "fair" fastness. Obviously neither of these results may be taken as accurate and authoritative. However, if a set standard is used by all workers in establishing comparisons, their results will probably more nearly coincide and they can be intelligently interpreted by anyone who understands the nature of the test. Up-to-date scientists realize this and the result has been that standard tests are becoming more and more accepted and approved. Under such conditions a purchaser will know exactly what he is getting when a product, which has been tested according to a standard method, is labeled as being of a certain quality.

Standardization of manufacture is also to be looked upon favorably. A standard product will be known by everyone; it will therefore be easier to market such a product and the selling costs will be cut down proportionately. It is impossible to standardize all merchandise, as some of it appears on the market only for a short time and then disappears. Such things may be classed under the head of novelties, and, while a profitable source of income in selling to the public at large, have no interest to the large business buyer who uses industrial products. Standardization of product will further the cooperation between buyer and seller: the buyer will know exactly what he wants and the seller can very easily show whether or not he has the identical item.

In naming of products according to a set standard there are more difficulties to be found. A certain company will have a well established line which it has handled for years and sold under a particular trade name. It has built its advertising around this trade name and its products are known to the buyers by this particular feature. It would not be easy nor profitable for such a company to change the name of its goods. Yet, at the same time, some other business house may sell the same substance under a different brand, possibly at the same price and probably at another. To a new buyer in the field or to one who has bought all of his supplies at one house, such a condition is confusing and misleading. If both concerns sold the same product under the same name, and it was tested by standard methods, then the buyer would know just what he was getting and what would be a reasonable price to pay for it.

Such a condition would undoubtedly lead to a standard price: "Standard" in the sense that a purchaser will only pay so much for an article if he knows its true value and that he can get it elsewhere at that price. The price would be set then as now by the condition of the market in relation to supply and demand. The same price would have to be met by all houses if they wished to continue in the running.

Although much has already been accomplished along this line, more particularly in regard to experimental work and testing methods, there is more that can be accomplished. However, standardization, has always resulted from chaotic disorder and it will eventually take care of itself, although it can be hurried by proper encouragement.

TOO MUCH SCIENTIFIC KNOWLEDGE

IN AN editorial recently appearing in the *American Wool and Cotton Reporter* under the above name it was stated that a large rubber manufacturer uses hundreds of thousands of yards of cotton fabrics every year. It is further stated that there is only one bleachery and only one dyehouse that can satisfactorily handle the goods for them, both of these concerns being very small estab-

lishments which operate solely on a rule of thumb basis, having very little knowledge of scientific chemistry. On the other hand the biggest dyeing and bleaching concerns in the country specializing on industrial fabrics were unable to do the work satisfactorily.

To quote from the editorial: "The head of the rubber company says that the success of these two smaller concerns in their work is that they are not scientific, that they are rule of the thumb and practical and that they will work with the rubber company to achieve the desired results. The rubber manufacturer says that these two small concerns do their work with the fabrics themselves rather than with pencil and paper. That these two small concerns will agree with the rubber manufacturer that the latter's methods are different than in any other rubber mill while the great big scientifically controlled bleacheries and dyehouses will not admit that this one manufacturer has any different processing than the other rubber manufacturers.

"In other words, here are several instances of too much science, too much technical and chemical knowledge and not enough of old practical experience and rule of thumb methods. Proof enough—in at least this score of bleacheries and dye work that the old practical manufacturer with years of experience and craft knowledge has something that cannot be acquired by a technical and scientific training, only by years of practical experience and a personal ability to admit that actual practice makes perfect."

It seems a little far-fetched in this day and age to believe that the old rule of thumb dyer and bleacher has something on the modern, scientifically controlled establishments. To be sure, experience does count for something, but does not the proper training for a position in a modern plant incur a certain amount of experience? What it took the rule of thumb worker to acquire in years of hit or miss methods of obtaining results the technically trained operator has learned in a much shorter space of time. It is still true that "a smart man learns from his own experience while a wise man learns from the experience of others." Hardly does it seem possible that the old worker has something that cannot be gained by the modern scientist. It may be that the up-to-date plant uses a paper and pencil, but it is generally used to advantage. Why spend two or three days in working out a problem by trial and error when the same thing can be solved on paper in five minutes? Although the large plants operate on a production basis each problem is treated separately and the client has the advantage of dealing with men who are experienced in business methods rather than with one man who may after many attempts produce the desired results. By the proper approach to each problem in a scientific manner, time is saved and the results are easy to duplicate. Where one man is operating a dyehouse with his pet formulae carried in his head or his notebook, who is going to satisfy the client when he is gone? In a scientific plant everything is carefully recorded so that even though one worker may not be there a year hence it will be easy to reproduce his results from the record kept by his *pencil and paper.*

There is an advantage in working directly with the object in question and the modern research laboratory spends more time in this respect than the old fashioned dyehouse and the results are intelligently interpreted so that they may be of help in solving future difficulties.

In this particular instance the rule of thumb dyer may have been able to satisfy the rubber manufacturer, but in the long run it is the company with men scientifically trained that will be of the most benefit to all concerned. To say that there is too much scientific knowledge is to return to the attitude of our grandfathers who said that man would never fly. But to be appreciated properly such knowledge should be sufficiently combined with experience so as to be practical in application.

Swiss Dye Industry in 1930

The Swiss dye industry, represented chiefly by Basel firms, probably fared better during 1930 than did most other branches of domestic industry. Until the end of September, the export trade of Basel firms manufacturing coal-tar dyes showed only a slight decrease compared with the same period of the preceding year. During the last three months of the year, however, the decline in the trade was more marked. The 1930 figure is the lowest since 1926.

Change in Staff

George Gordon Osborne, Assistant Professor of Knitting and Designing in the Textile School of North Carolina State College, has been granted a year's leave of absence in order to pursue advanced work at Harvard University. He had practical experience with Cheney Brothers and other manufacturers before coming to State College.

Mr. Osborne will be succeeded by D. B. Hardin, a graduate of the Textile Department of Texas A. & M. College, who has acted as a teaching fellow in the State College Textile School for the past two years while doing work for an advanced degree, which he received at the last commencement.

1931 Fall Hosiery Colors

Ten new shades will be shown on the 1931 Fall Season Hosiery Card to be issued shortly, it was announced today by the Textile Color Card Association. Advance swatches of these colors have been sent out to members in the hosiery industry.

The Association, in creating these shades, has not only considered their fashion importance, but has coordinated them with the colors promoted by the apparel and retail trades. They are especially keyed to the basic coat and dress colors adopted for Fall by the Color Coordination Committee of the National Retail Dry Goods Association.

The hosiery colors also coordinate with the official shoe and leather shades selected by the Association in collaboration with the Allied Shoe and Leather Industries.

The Action of Caustic Soda on Cellulose*

By S. M. NEALE

THE subject may from the technical point of view be classified under two headings corresponding to the two main industrial processes in which caustic soda acts on cellulose. The first is essentially a cleansing process, in which natural celluloses are boiled with dilute alkali in the absence of air, in order to remove impurities. As a result of such a treatment no apparent change occurs in the cellulose itself, save only that it yields a less viscous solution in cuprammonium hydroxide as the severity of the boil is increased The second type of process depends on the swelling of cellulose which takes place in concentrated alkali solutions at the ordinary temperature. Such solutions are employed in the mercerization of cotton yarns or fabrics, yielding a product which has an enhanced luster and other desirable textile qualities. The present paper deals only, and in restricted fashion, with this latter aspect of the question—the action of moderately concentrated alkali at the ordinary temperature. The development of the process of mercerization and scientific work on the subject up to 1922 have been very adequately treated by Clibbens in a summary of the literature published in 1923.[7] The original process of Mercer, in which the fabric was allowed to shrink freely, and the subsequent discovery by Lowe that if tension were applied the shrinkage was prevented, and at the same time a permanent luster was acquired by the material, are matters of common knowledge. It will therefore be profitable to devote attention mainly to recent developments, and the present paper deals especially with the less obvious changes in the properties of cellulose which are effected by treatment with alkali. Before dealing with this, however, it is desirable to review briefly a theory recently put forward by the author,[13] which gives a partial and somewhat qualitative explanation of the action of caustic alkali on cellulose.

Mechanism of the Action of Caustic Soda

It is supposed that certain of the cellulose hydroxyl groups exhibit very weakly acid properties, and react with sodium hydroxide forming an ionized sodium salt to an extent depending on the concentration of hydroxyl ion. On account of the weakness of the acid, the salt may be completely hydrolyzed by washing with large quantities of water. On this hypothesis the system cellulose-sodium hydroxide-water may be depicted as follows:

	Gel phase	Solution phase
Undissociated acid	$H{\cdot}C_6H_9O_5$	
		$Na + OH$
Ionized Salt	$Na_+ + C_6H_9O_5{}_-$	H_2O
Free alkali	$Na_+ + HO_-$	
Water	H_2O	

It is to be presumed that the anionic $C_6H_9O_5$ residues are joined together with the unchanged residues in long chains, which are themselves united laterally by secondary valences, the whole network forming a rigid visible structure. In such a system, in which the gel is permeable to the water and alkali molecules, the amount of salt formation should depend on the concentration of free hydroxyl ion in the gel phase, and this should, in turn, be determined by the Donnan equation of membrane equilibrium,[10] according to which the product of the concentrations of two diffusible ions of opposite electric charge is the same in both phases. A further reasonable supposition would be that the swelling of the cellulose which occurs in such a system arises from the osmotic water attraction of the gel phase, owing to the concentration of ions resulting from salt formation, being greater than that of the external solution. Such a theory explains why the swelling at first increases up to a maximum, and then falls as the alkali concentration is increased. In the first stage—that of increasing swelling—the amount of alkali "fixed" by salt formation is increasing rapidly, and so the osmotic water attraction of the gel increases more rapidly than that of the solution. During the second stage of increasing concentration the extent of cellulose salt formation is virtually complete, and the increasing osmotic water attraction of the solution withdraws water from the gel phases—*i.e.*, the cellulose is less swollen. There are several corollaries of the theory which are of interest. Since the hydrolysis of salts is less pronounced at low temperatures the amount of cellulose salt formation, and hence of swelling, should be greater. This is confirmed by experience. [1, 3] and a process for imparting a linen finish to cotton goods is founded on the fact. Again, if the swelling of cellulose is an osmotic effect, an abnormally great transient swelling may occur if material in equilibrium with a concentrated solution is suddenly immersed in a

* Chemistry and Industry, Transactions of Society of Chemical Industry.

more dilute one. This effect is easily demonstrable,[13] and it may, in practice, cause serious trouble in the mercerization of mixed cotton rayon fabrics. It can be avoided by washing off the alkali with brine instead of with water. A third consequence of the theory is of theoretical interest only. If the concentration of free alkali in the cellulose phase is not equal to that in the external solution, but is determined by the Donnan equation, then it follows algebraically that the amount of salt formation is not equal to the preferential absorption of alkali from the solution, but, at high concentrations, is approximately twice that amount. On this account, the evidence on which Vieweg and others[7] concluded the existence of a compound $C_{12}H_{19}O_{10}Na$ is rather to be interpreted as pointing to a more likely substance in which one molecule of alkali reacts with each glucose residue. Rumbold[15] has recently studied the absorption of caustic soda from dilute solution by cotton and mercerized cotton, and has found breaks in the absorption curves from which he infers the existence of the compounds $(C_6H_{10}O_5)_{12}$,NaOH and $(C_6H_{10}O_5)_6$.NaOH. The author[14] has, in his own work on similar lines, found no evidence of such effects. The respective observations are compared in Fig. 1.

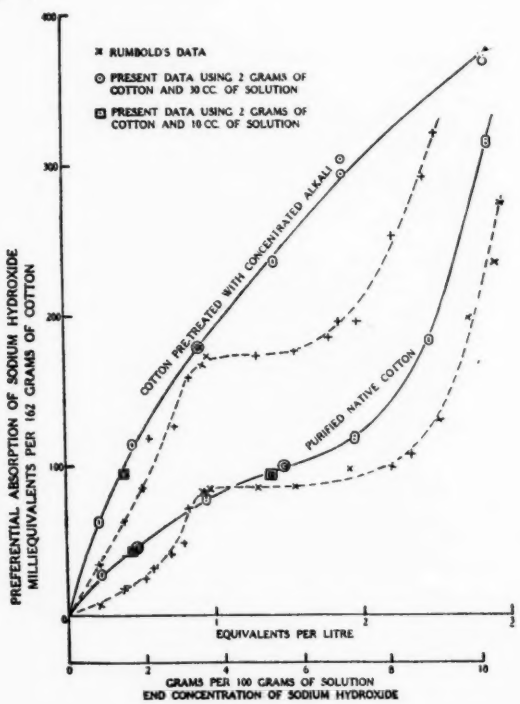
RUMBOLD'S DATA
PRESENT DATA USING 2 GRAMS OF COTTON AND 20 CC. OF SOLUTION
PRESENT DATA USING 2 GRAMS OF COTTON AND 10 CC. OF SOLUTION
COTTON PRETREATED WITH CONCENTRATED ALKALI
PURIFIED NATIVE COTTON
PREFERENTIAL ABSORPTION OF SODIUM HYDROXIDE MILLIEQUIVALENTS PER 162 GRAMS OF COTTON
EQUIVALENTS PER LITRE
GRAMS PER 100 GRAMS OF SOLUTION
END CONCENTRATION OF SODIUM HYDROXIDE

FIG. 1

PERMANENT EFFECTS OF ALKALI TREATMENT

Although the whole of the alkali can be removed by washing from cellulose which has been immersed in caustic soda solution, if this solution has been sufficiently concentrated to swell the cellulose, it is found that the properties of the product differ from those of the original material. Cotton hairs suffer a permanent shrinkage, or if this be prevented by the application of tension, permanently acquire an enhanced luster. This has been attributed to the greater roundness of cross-section of mercerized hairs, but this cannot be the whole story, for on this basis alone cotton mercerized without tension, which shows the most nearly circular section, should exhibit the greatest luster.

The tensile strength of cotton fabrics is often increased as a result of mercerization, but the evidence seems to show[7] that where such increase occurs it is due to better cohesion and bedding together of the hairs and not to any increase in the intrinsic strength of the latter.

Apart from these more superficial effects, however, it is found that cellulose, as a result of any pretreatment which causes swelling, suffers a general increase of reactivity which may be called "activation." Sodium hydroxide solution, as a typical swelling agent, is one of the reagents capable of bringing about this effect. In such "activated" cellulose, it is found that all the properties characteristic of the original material are displayed in greater capacity, but not with greater intensity—for example, the absorption of water is greater, and greater in the same ratio from all concentrations of water vapor.[17] On the other hand, no essentially new chemical properties are developed, and this distinguishes the type of change ("activation") brought about by pretreatment with swelling agents from that other class of changes ("degradation") induced by the action of acids or oxidizing agents. In order to make quite clear the distinction between these two fundamentally different ways in which natural cellulose may be modified, their effect on the properties of the material is compared below:—

Property of cellulose	Effect of previous swelling (as in NaOH soln.) causing "activation"	Effect of previous acid or oxidizing attack causing "degradation"
Absorption of moisture	Much greater[17]	Slightly less
Absorption of direct dyes	Much greater[12]	May be less[4, 6]
Rate of attack by acid	Greater[16]	Unchanged[16]
Rate of attack by alkaline hypobromite	Greater[3]	Unchanged[3]
Absorption of alkalis from dilute solution	Greater[14]	Unchanged[14]
"Copper number"	None[8]	Greater[3, 4]
Methylene-blue absorption (basic dye)	None[9]	May increase[4]
Intrinsic strength	None[7]	Falls[11]
Viscosity of solution	Falls[11]	None[11]

It is not possible to give any exact interpretation of these changes in terms of the ultimate structure of cellulose, but it may be conjectured that in the first type of change ("activation") some loosening of the structure occurs leading to a greater accessibility of reactive points. The second type of change ("degradation") no doubt implies the breaking of some of the primary valency oxygen linkings between the hexose residues, accompanied by the appearance of new chemical groupings, such as the reducing ·CHO and the acidic ·CO_2H.

The amount of activation which is effected by pretreatment with caustic soda depends on a large number of factors, notably the presence or otherwise of any mechanical restraint on the swelling of the cellulose, but for the purpose of comparing the results of various tests

on the product it is convenient to consider in the first instance the effect of variation of concentration of the pretreating alkali solution, under conditions such that mechanical restraint on the swelling of the cellulose is, as far as possible, avoided. Of the various quantitative tests of "activation" of cellulose given in the table above, it has in most cases been shown that much the same figure is obtained from all forms of unswollen carefully purified natural cellulose. Furthermore, it has been found that the activation expressed as a ratio relative to the reactivity of purified natural cellulose is, as measured by any given reagent (water vapor or dilute alkali, for instance), independent of the concentration of the particular test reagent employed. It is, therefore, permissible to express the state of activation of any sample of cellulose towards a given reagent as a ratio relative to purified natural cellulose. The activation ratios of a given sample of cellulose towards the various reagents are in general different, and the following table illustrates this in the case of purified cotton activated by pretreatment in a loose condition with caustic soda solutions of various concentrations. Some of the values given have been interpolated so as to facilitate comparison at the same alkali concentration, but since they refer in general to different materials prepared by different workers, such comparison should not be regarded too strictly.

	Activation ratios towards						
Conc. of NaOH used in pretreatment g./100 g. soln.	17 Water vapor	3 Alkaline hypobromite	16 5% H_2SO_4	12 Benzopurpurin 4B	14 0.5*N*-NaOH	14 0.2*N*-$Ba(OH)_2$	6 Dilute cuprammonium
0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
10.0	1.1	1.0	1.1	—	1.2	1.2	—
12.5	1.4	1.3	—	—	1.9	1.9	—
15.0	1.6	1.6	1.7	—	2.3	2.4	—
20.0	1.5	1.6	—	2.2	2.4	2.6	—
25.0	1.6	—	2.2	—	2.5	2.6	2.6
32.5	1.6	—	2.2	—	2.6	2.8	—

For the details of measurement of the various reactivities, the original papers should be consulted. Since it appears that activation of cellulose results from pretreatment with any reagent causing swelling, it is of interest to compare the amount of swelling of cellulose in sodium hydroxide solutions of various concentrations with the resulting activation. This is done in Fig. 2, where the shrinkage of lengths of cotton yarn and the swollen weight of regenerated sheet cellulose are used as measures of swelling and the absorption of dilute caustic soda as a measure of reactivity. The use of the former as a rough index is possible, since the anisotropic structure of cotton hairs causes them to shrink in length as they expand in diameter.[13] Fig. 2 shows that the amount of activation is largely determined by the extent of the previous swelling.

Apart from the effect which the concentration of the alkali used in pretreatment exerts on the reactivity of the product, it is found that a lower reactivity results if the swelling in alkali is restrained [3, 6, 14, 18]—in the case of

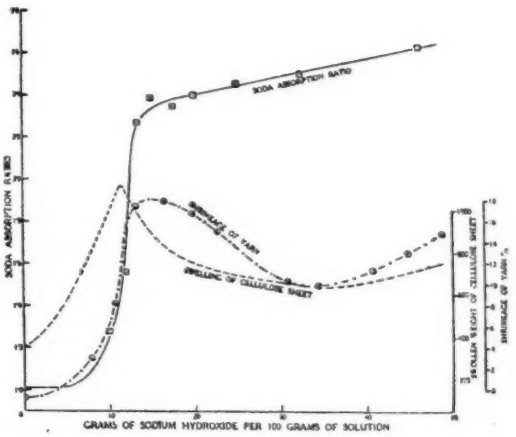
SODA ABSORPTION RATIO
SHRINKAGE OF YARN
SWELLING OF CELLULOSE SHEET
SHRINKAGE OF YARN %
GRAMS OF SODIUM HYDROXIDE PER 100 GRAMS OF SOLUTION

FIG. 2

cotton yarns or cloths by the application of tension—or if the product is dried at a high temperature or is scoured with boiling dilute alkali after the swelling treatment. The effect of two of these factors is illustrated in Fig. 3, in which the baryta absorption ratio[14] is used as a measure

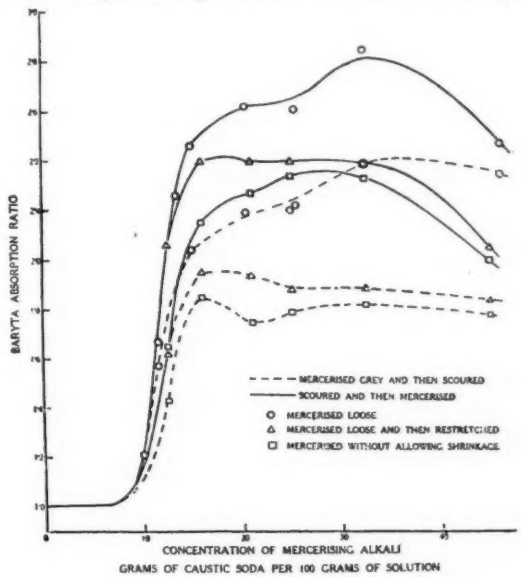
BARYTA ABSORPTION RATIO
MERCERISED GREY AND THEN SCOURED
SCOURED AND THEN MERCERISED
MERCERISED LOOSE
MERCERISED LOOSE AND THEN RESTRETCHED
MERCERISED WITHOUT ALLOWING SHRINKAGE
CONCENTRATION OF MERCERISING ALKALI
GRAMS OF CAUSTIC SODA PER 100 GRAMS OF SOLUTION

FIG. 3

of activation of cotton yarn. This quantity is perhaps the most easily and accurately measurable of all the characteristic chemical constants of cellulose. Fig. 3 shows not only the great loss of activation caused by subsequent scouring or by the prevention of shrinkage during mercerization, but also that if free shrinkage be allowed subsequent restretching in the mercerizing alkali decreases the activation appreciably. The effect of drying at a high temperature after alkali treatment is illustrated by the following figures.

Activation ratios of cotton yarn treated loose with 25% NaOH, washed till free from alkali

Reagent:	Water vapor	Alk. potass. hypobromite	0.5*N*-NaOH	0.2*N*-$Ba(OH)_2$
Air-dried	1.66	1.75	2.55	2.70
dried at 110°...	1.51	1.76	2.27	2.52

Since boiling with dilute alkali or drying at a high tem-

perature deactivates mercerized cotton, it is not surprising to find, as is well known, that washing off the mercerizing alkali with hot water rather than with cold has a similar effect.

The state of activation of cellulose is of technical importance, in so far as it determines the absorption of direct dyestuffs by mercerized cotton, though the exact relation between such absorption and the activation ratios described is not yet known. Again, it is probable that qualities of textile importance, such as luster and handle of mercerized yarns, are in some way related to the swelling and activation of the cellulose, but the relation is not simple, and is not yet understood. In the manufacture of rayon, which can be regarded as a mercerization process in which complete dissolution is substituted for mere swelling of the cellulose, the difficulty of obtaining a product of uniform affinity for dyestuffs is well known, and is more severe than the corresponding difficulty in the case of mercerized cotton. There is little quantitative knowledge as to how the pretreatment of cellulose and its state of activation as measured in various ways are related to the absorption of direct dyestuffs, probably on account of the lack of an easy and accurate method of determining the latter quantitatively. It is probable, however, that the irregular dyeing of rayon is to be attributed rather to unequal rates of diffusion of the dyestuff through the cellulose than to differences in the ultimate amount of dyestuff when dyeing is continued till equilibrium is reached.

The difficulties that arise in practice show that cellulose, when activated by swelling in mercerizing alkali or by dissolution in a solvent, is in a state of extreme sensitivity, so that the properties of the ultimate product may be affected by the slightest variations in technique.

The author wishes to acknowledge the kindness of Dr. R. H. Pickard, F.R.S., Director of the British Cotton Industry Research Association, for permitting reference to papers now in the press on behalf of the Association.

College of Technology,
Manchester

Discussion

The Chairman (Dr. R. H. Pickard) said that the mercerization processes as applied to the behavior of rayon had caused considerable trouble. The processes were very difficult to control, and the troubles which arose were perhaps only obvious at a very late stage in the process. For some years, Mr. Neale's work had appeared to be of a very theoretical character, but it was apparent, from the few hints which had been given in his paper, that the region between theory and practice was becoming very constricted.

In reply to questions, Mr. Neale said he thought that 1% sodium carbonate would have no great effect, if any. It would depend on the length of the period of reaction. The swelling action depended on the existence of the hydroxyl ion. In boiling with caustic soda the non-cellulosic constituents were dissolved. At the same time there was no action on the cellulose if air was excluded, except that there was a less viscous product in cuprammonium. He could not say whether the same remark applied to boiling with sodium carbonate. He did not think that the presence of oxygen in the mercerizing solution had any effect in practice.

He found it very difficult to follows the results of the *X*-ray research work of the German investigators. He had not been aware of the presence of a **W** formation. Probably the swelling in diameter, and the shrinkage in length, could be attributed to the spiral arrangement in cotton hairs and in regenerated cellulose to the pushing apart laterally of primary valency chains between points of attachment, causing the points to approach longitudinally, much as a trellis expands in one direction and contracts in another.

Mr. Barkla asked whether swelling and reactivity were really parallel phenomena. Swelling was comparatively a rapid process. After the mercerized cellulose had been ground it must be kept for some time before sulphurization took place to any great extent. Some reaction seemed to occur during ageing process, which was exothermic. After grinding, there was a definite rise in temperature during about 36-40 hours. This evolution of heat did not occur in the total exclusion of oxygen.

Mr. Preston said that there was a parallel case in the work of Karrer, who had found that the degree of saccharification of cellulose after a given time by cellulase was very much increased if the cellulose was pre-treated with caustic soda to mercerize it. Further, the increase was greater when the cellulose was mercerized without tension. The same considerations applied to viscose rayon, which when spun without tension offered less resistance to enzyme attack than similar rayon spun with tension. It would be interesting to know if micro-organisms attacked mercerized cotton more than unmercerized cotton, since it seemed probable that they must act through the medium of some enzyme similar to cellulase.

Mr. Neale said that the work which had been done with regard to cotton had been in connection with ordinary moulds and bacteria which attacked the non-cellulosic constituents. With cellulase no doubt the effect would occur. The point raised by Mr. Preston was interesting as showing what widely differing processes might be used in attempting to measure activation of cellulose.

He further said the wet cellulose was undoubtedly more active. It was not possible to measure the reactivity of the wet substance by means of the methods he had indicated, but it was possible to measure it, by dyeing the materials, in a qualitative way. In the wet methylation process a large number of free reactive hydroxyl groups were available, and the amount of methylation was not sufficient to destroy all these. The condensation caused by drying left some of them still available. When the same amount of methylation was effected on the dry cellulose, the smaller number of available hydroxyls were all used up, and an inert product was obtained.

Barium and ammonium hydroxides did not cause any swelling of cellulose. Barium seemed to cause shrinking. Two German workers had found that caustic soda in presence of oxygen at elevated temperatures attacked cellulose fairly severely. On purely general grounds, he would be surprised if there was not an increase of the copper number after 48 hours' treatment in the presence of air.

MR. PRESTON said it had been found by Knecht and Egan that if cellulose was oxidized in an alkaline medium the oxidized cellulose dissolved as it was formed, with the consequence that the copper number of the final product did not increase appreciably. There was, however, a disappearance of the cellulose which was shown by a loss in weight. This result explained the reason why the "ageing" to which alkali-cellulose was submitted during the manufacture of viscose rayon did not increase the copper number, because the oxidized cellulose formed during this "aging" was dissolved during the subsequent treatment with caustic soda solution. In fact, the copper number of the regenerated cellulose was less than that of the original cellulose which formed the starting point.

MR. NEALE said that the action of alkali, particularly at the boil, tended to destroy the reducing oxycellulose. The reducing property disappeared, and there was a loss in weight. The material was, however, still tendered or degraded, and this could most easily be shown by the viscosity in cuprammonium.

MR. WATKINS said that mercerization of cotton at about 30° Tw. and upwards caused a progressive decrease in the thickness of the yarn after the process was completed. At the ordinary mercerizing concentration of 60° Tw. there was a decrease in thickness of the yarn of about 18%. It had been stated that, of the three types of cellulose—alpha, beta, and gamma—the last-named was cellulose soluble in caustic soda solution. Did the author think this had anything to do with the thinning down of the yarns on mercerizing?

MR. NEALE said the loss of diameter was probably not due to any loss in weight. Cross-sections of cotton hairs were of various shapes, and by treatment with alkali under tension they became more or less hexagonal. When the alkali was washed off and the material dried the hexagons took up less space. If the shrinking of diameter could be counteracted then the luster might not be obtained.

MR. LOMAX referred to the activity ratio being diminished if as a part of the mercerizing process there was any washing by hot water. There was a higher activity ratio by washing with cold water. He did not think it was possible to wash all the caustic out of yarn by an ordinary mercerizing process sufficiently to prevent shrinkage by merely using cold water. This shrinkage might be the cause of the higher activity ratio.

MR. NEALE said there was no serious time factor as apart from penetration. The action was instantaneous and as rapid as the mercerization could be carried out except if the most concentrated alkali solution were used, when 24 hours would be required to obtain the maximum effect. With alkali up to 40% the shrinkage was practically instantaneous.

MR. HAMILTON asked if grey cloth were mercerized with a liquor containing wetting-out agents and then bleached would the resulting white cloth be as reactive and as lustrous as the same cloth, bleached first and then mercerized in a liquor containing no wetting-out agents?

MR. NEALE said the reactivity with the grey was not as great because it was scoured afterwards. It was the subsequent purification which caused the effect, not that the mercerization took place in the grey state. There had to be a purification before there could be a test, and the purification involved some loss of activation.

MR. WOOD said that if a silica gel was boiled with water it lost water. He assumed the same thing happened in the case of mercerized cotton.

MR. NEALE said it did not seem to apply in the case of ordinary unmercerized cotton, which absorbed most water at 100°. When mercerized wet it might actually shrink in volume on boiling, like the silica gel; in fact, he assumed it did not shrink or else it would not lose its activity.

MR. W. F. A. ERMEN referred to an attempt to improve, or at any rate modify, the luster of ordinary mercerized cloth by impregnating the cloth, before it went into the mercerizing machine, with cuprammonium solution. When the cloth came out at the other end of the machine it appeared to be superior in luster. There was a trace of copper in the cloth. The material went forward into the kier to be scoured a second time, as was customary, and it was found to be completely broken up where the copper solution had been applied, showing that oxidation had been extraordinarily rapid in the presence of the caustic soda. It did not appear to be tender after it left the mercerizing machine. Before it got into the kier it had become so tender that it simply dissolved during the second boiling.

THE CHAIRMAN said that the result might be due to the fact that, in the case of cuprammonium, nitrite was developed very quickly in the presence of oxygen.

MR. NEALE said it was well known that oxidation could take place in the kier in the presence of caustic soda and air. Copper was a very active catalyst for the purpose of oxidation of all kinds.

MR. R. J. HANNAY said it was known that when there were stains of copper on grey cloth there were holes formed in the cloth when it came out of the kier without any mercerization.

MR. F. SCHOLEFIELD thought that the activity of caustic soda in contact with cotton submitted to air action was not sufficiently appreciated. It was a matter of observation in the dye house that if cotton was allowed to remain saturated with caustic soda for some time, especially in light, it formed oxycellulose very readily, as was shown by the difficulty of producing level shades afterwards.

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"What Is Being Done, and What Can Be Done In the Field of Distribution Research In the Textile Industry"

Abstract

A. W. Zelomek
Statistician-Economist, Fairchild Publications

"IT will be absolutely essential for the various companies in the textile industry to give greater heed to distribution research than they have done hitherto, for the industry could hardly go through another 10 years of a profitless era without dire results," according to A. W. Zelomek, statistician-economist of the Fairchild Publications, who addressed the U. S. Institute for Textile Research at the Mass. Institute of Technology. His subject was "What is Being Done and What Can Be Done in the Field of Distribution Research in the Textile Industry." Mr. Zelomek stated that the textile industry has reached a point where further depreciation of capital can hardly continue much longer. He stated that research is a part of the equipment of any industry and textiles are no exception.

He also said that the lack of understanding of the markets that the textile industry is serving was probably one of the major reasons for the profitless era during the past decade, while industry in general was experiencing the most favorable earning period in its history.

At the present time, very little distribution research is being done. Distributing research is confined largely to one or two leading organizations and even here it is hardly complete. The industry, thus far, has accomplished very little in tracing the movement of its products from the time they are woven, whether in New England or in the South, to the time they reach their ultimate destination. This is in contrast to the trend evident in the automotive industry wherein it is easy to trace the movement of a Ford car from the Dearborn factory to its ultimate destination. He pointed out that the need for studying the market is probably as great in textiles as in other branches of industry.

One of the points Mr. Zelomek stressed was that the problem of distribution is more intense today than ever before because of the style element. This problem will become more complicated with the increasing style-consciousness of the American public. At the present time, very little attempt is made to study the movement of style merchandise, whether by products, fabrics, colors or by communities. The tendency seems to be to merely follow the leader, and lamentable results usually accrue from such a procedure. In turn, over-production ensues as it is found that the market can hardly absorb all production that is concentrated on one fabric or color. This is due to lack of knowledge of the volume of sales of any particular item or items.

Mr. Zelomek also emphasized the need for determining the potential output of a fabric or fabrics and correlating this information with the distribution or sales of these items. The sales records of most organizations contain sufficient information to enable them to study this much more intelligently than is done at present. The industry has utilized very little of its own facilities which are available in its records. He also pointed out that the increasing production of all textile fibres and the low prices of these items will mean increasing competition not only between various fabrics in the same group but among the various textile fibers. Therefore, the necessity for studying the movement of each industry in relation to the others, is most essential.

Thus far, very little data is available regarding the women's apparel industry, despite its importance. Lack of knowledge of this industry has been a contributing factor to unfavorable conditions, particularly in the silk industry. Recent changes have taken place in the women's apparel industry so that conditions today are different than they were several years ago, especially with various organizations entering different price ranges.

The concluding message left by Mr. Zelomek emphasized the fact that there was no need of setting up elaborate, complicated research departments, the cost of which would far exceed the values derived. He did, however, stress the need of knowing the movement of the various products.

Coat and Dress Colors

A pocket size card showing the basic coat and dress colors for Fall, selected by the Color Coordination Committee of the National Retail Dry Goods Association, will be issued by the Textile Color Card Association shortly, it was announced by James L. Fri, Manager of the Merchandise Managers' Division of the National Retail Dry Goods Association.

It was explained by Mr. Fri that these basic colors for coordination in apparel and accessories for volume selling were being issued in this compact form primarily as a guide to buyers when in the market placing orders for Fall merchandise.

Technical Notes from Foreign Sources

Fractional Precipitation of Cellulose Acetate (with Particular Reference to Artificial Silk)

Fritz Ohl—Kunstseide 12,468 (1930).—Work has already been carried out by more than one investigator along this line, but only from the purely chemical or physical standpoint, for the most part; for example, in reference to the process of acetolysis, etc. Some work already done suggested that, above all, the size of particle of cellulose acetate, as well as its physical structure and content in impurities, degradation products, etc., might be of considerable influence upon results in spinning by various methods. Not much information was available as to the mode of preparation and the antecedent history of the material here studied; about the only facts available were, that the material had been precipitated from its hydrolysis-solution with more or less warm, or with cold, water, as the case might be. This simple fact, as to the temperature of precipitation, proved to involve some interesting results.

Commercial acetyl-cellulose was first employed in this study. A 5% solution of it, in anhydrous condition, was prepared, with anhydrous acetone-alcohol as the solvent. According to experimental information previously obtained, this solution was decomposed into 3 fractions with distilled water of 20° C. The first fraction yielded a product which, when redissolved in acetone, gave a solution of high viscosity, which, however, contained most of the impurities, inorganic and organic, present in the original cellulose acetate. The second fraction consisted of a very pure cellulose acetate, which was obtained in part in a crystalline form, almost free from impurities. The third fraction gave a solution (when redissolved) of strikingly low viscosity. The copper number of this fraction was also considerably higher than those of fractions 1 and 2. It evidently consisted of a very impure cellulose acetate, mixed with the various impurities, degradation-products, and so on, originally present in the sample. According to quantity, the first fraction was the largest, then fraction 3, then 2.

The three fractions were dissolved to 20% solutions in mixtures of anhydrous acetone and alcohol in the ratio of 8/2, the temperature of solution 20° C., duration of stirring 6 hours, care being taken to prevent loss of solvent by evaporation. Each was filtered 3 times, and then examined for viscosity, and also spun into filaments for study.

The general behavior of the material of the three fractions made it evident that the commercial cellulose acetate is by no means a homogeneous substance. The fractions were not distinguished by any regularity in variation in the acetyl content. Beside the differences in the copper number, rotative value, viscosity, etc., they did differ in their ash content also. It was possible to split up each fraction still further, in similar manner, into other fractions, these also differing from each other in much the same way as the major fractions. The particle-magnitude of the original substance is evidently very varied.

A number of tables is given, of the results of the study, which are summarized thus:

1. The different fractional products yield solutions of different viscosity, and filaments of different tensile strengths.

2. The different precipitation-values are principally to be ascribed to different particle-size of the different products.

3. The size of particle is not uniform in the different fractional products; there can be obtained further subfractions of a different order of particle-magnitude.

4. The tensile strength of the filaments spun from the different fractions increases with increasing purity of the material spun; it decreases with the increase of impurity therein contained, such impurities, either organic or inorganic, being of unfavorable influence.

5. Through suitable mixtures of products consisting of pure acetyl-cellulose of different particle-magnitude, the tensile strength of the filament spun therefrom can be considerably increased. The optimum proportion lies between 10 and 20% of addition of a product whose particles are of lower magnitude.

6. No exact relation exists between viscosity of a solution and tensile strength of the fiber spun from it. For corresponding mixtures neither the viscosity values nor the tensile strengths are additive in nature.

Further work was carried out, employing pure cotton acetylated under definite conditions by the author, extreme care being taken to guard against accidental impurities being introduced. The product was, as before, fractionally precipitated (3 fractions), under the same conditions as before. Examination of the three fractions, carried out exactly as before, gave the same results as before. In addition, another series of precipitations was carried out at 60° C., and examination of the three fractions in this case led to the conclusion that warm precipitation

1—is of a specially active nature at the beginning of the first precipitation,

2—brings about precipitation of the greater part of all organic or inorganic impurities at the very first (fraction 1),

3—brings about a more satisfactory separation of the larger and smaller groups of particles, as well as the degradation-products formed during acetylation.

The article closes with certain other general conclusions:

1. The tensile strength of a filament is dependent upon a suitable relation between the coarser and finer particle-magnitude groups in the original material.

2. The larger particle-magnitude must predominate in order to attain the highest tensile value. With the presence of much material of the lower particle-magnitude (pure acetyl-cellulose), the depressant effect of this material can be compensated for through higher tension in spinning, up to a certain point. A product consisting mostly of particles of higher magnitude is not suitable for spinning under higher tension.

3. Organic impurities, such as are separable through filtration, are of no essential influence upon the tensile strength of the filament. A high content in inorganic impurities will decidedly depress the boil—and storage-stability of the fiber.

4. The intermediate and degradation products which always form, which also are not easily separable through repeated filtration, always and decidedly repress the tensile strength of the filament. These substances are always present more or less in the ordinary commercial cellulose acetates, but, as has been shown, they are mostly separated in the fractional precipitation of the acetate from the hydrolysis-solution.

5. The method of precipitation of the cellulose acetate is of influence upon the state of subdivision of the constituents. Warm precipitation separates the different components in a more compact form. The impurities, e.g., incompletely acetylated cellulose, degradation-products, etc., are more firmly and especially more irregularly included (entrapped) in the precipitation-material.

Acetate Silk

Dr. Krueger—Kunst-Seide 12,262 (1930).—A lengthy, thoroughly good review of our knowledge of the product, its various modes of formation, its properties, all full and detailed, with 54 references to a still greater number of papers. A paper of solid value, much different from the compilations of references sometimes seen.

Dyeing of Acetate Silk

H. Brandenburger—Kunst-Seide 12,267 (1930)—.The subtitle reads "Contributions to the Theory of the Photochemical Decomposition of Acetate Silk Dyestuffs."

The author favors the view that in case of this material the phenomenon of dyeing consists in a solvent action (solid-solution formation) and not absorption or adsorption or chemical reaction of an obscure sort. The theory of G. Ziersch (Doctoral Dissertation, Dresden, 1929) explains the process of fading by the assumption that each chemical substance exerts a selective action upon the light-components of the different wave-lengths, depending upon the substance's constitution; these selected waves are the ones which exert specification. Through this specific absorption of particular wave-lengths a rearrangement of the vibratory character of the light-rays is brought about, through which the well-known chemical alteration of the substance is caused. This process of rearrangement is considered to take place through the intra-molecular vibration condition of the substance being altered, the rate of vibration being altered, amplified, by the selected light-waves, to form resonance-vibrations, which bring about an increase in the amplitude of vibration within the molecule. By this increase in the internal vibratory energy, the molecule is brought into an especially "excited" condition, which essentially favors the activity of any not totally saturated valence-fields; or it may be of such extent that a direct rupture of the molecular union, and a physical breaking up of the substance, is brought about. Such a possibility exists, of course, only when there are unsaturated valences to be attacked. Evidently, too, either a molecular cleavage of some sort takes place at once, or else what may be called an activation (of the internal molecular vibratory condition) takes place, which ultimately leads to final cleavage of the molecule. The azo group is well known to be the most sensitive spot in all dyestuff molecules.

In reference to the question of whether, in general, the alteration of dyestuffs by light is of oxidative or reductive nature, no general agreement yet exists. The oxidative theory seems to be most held at present, if we include the auto-oxidative theory of Engler and Weissberg. The theory in one form or another does seem to explain most, at least, of our problems. The reductive theory has little except a few special cases to commend it. The third theory, the so-called enzyme theory, is still in an elementary form.

In one case, at least, we possess some definite information, though the interpretation of this is not as yet as extended as desirable. In the case of cotton, the dyestuff deposits in the micellular junctions as aggregates, which, as shown by Haller and Ruperti, can be caused to coalesce into larger aggregates by steaming. Ziersch has now shown that the fading process occurs only on the surface of such a dyestuff granule; in the case of Naphthol AS dyeings, these, when apparently thoroughly faded, can be restored to their original brightness by a thorough hot soaping. It may safely be concluded that the oxidation product, the faded substance, formed on the surface of the dyestuff granule, was simply dissolved off by the soap bath, thus exposing the unfaded interior of the granule, and causing the fabric to reassume its original appearance (less rich, however, in dyestuff: determination of the depth of tone as compared with the original would be interesting).

However, with acetate silk, the dyestuff is not thus aggregated, but is dispersed much more effectively throughout the structure of the filament, in a much more finely divided form. Accordingly, and also because acetate silk fiber is transparent to light of the shorter wave-lengths, the dyestuff is much more easily and quickly attacked by light, and more completely, too, being mostly, so to speak, in a condition which is more surface than interior.

Skein Dyeing Machine

A NEW type skein dyeing machine, fully guaranteed for the application of vat colors to silk, cotton and rayon skeins has been developed. The manufacturers claim that at all times during the dyeing and washing processes, the material is absolutely safe from physical injury, as well as from premature oxidation.

It is stated that the finest of silk, cotton and rayon yarns are left in excellent winding condition, even after unusually prolonged dyeing periods, and that there is a decided economy effected in dyestuffs and chemicals, due to the fact that the ratio of dye liquor to yarn may be held as low as 12 to 1.

This machine operates on the principle of the movement of both yarn and liquor.

Since all other machines have operated on the principle of either: One, moving the yarn through the liquor, or; two, moving the liquor through the yarn, it is at once evident that this machine in embodying both principles is a radical departure from what was heretofore considered standard practice.

The movement of yarn on this new machine is said to be very slight—only enough to occasionally shift its position to insure uniform action.

The movement of liquor is described as very great—the entire bath passing through the yarn under low pressure once each minute.

Fundamentally, the machine is considered simple, consisting of a specially designed perforated tube on which the yarn is hung—directly below the yarn is a monel metal tank or container for the dyebath.

Between the tank and yarn tube is a pump which draws the liquor from the tank and forces it into the special perforated tube and through the yarn back to the tank.

The movement of the liquor through the yarn is at such rate that the entire bath passes through the material and back to the tank once each minute.

To insure uniform action on all parts of the skeins, automatic means have been provided to occasionally shift the position of the material on the tube.

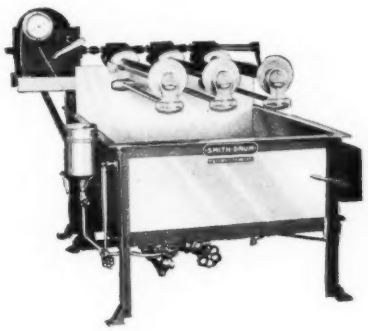
Because of the novel combination of principles, the manufacturers claim:

(1)—The combination of moving both yarn and liquor insures absolutely perfect and even penetration.

(2)—Possibility of maintaining a totally submerged condition of yarn without the disadvantage of a long bath. They state the proportion can be as low as 12 to 1 or as high as 30 to 1.

(3)—Tangling of fine yarns is prevented, due to the fact that there is a dwell of two minutes between each movement of the yarn, and this movement is very slight. In addition to this, the downward flow of liquor over and through the yarn tends to keep each thread in its original position.

(4)—Additions to and heating of the bath can be easily accomplished because the yarn is never in direct contact with the main body of liquor. This prevents possibility of blowing or matting of threads due to agitation when heating or mixing.



3-Tube Machine.

(5)—Automatic means for thorough mixing of bath has been provided for as a further safeguard and convenience.

(6)—Undissolved dyestuff and chemicals and dirty steam cannot cause trouble because the entire bath is filtered once each minute before it comes in contact with the yarn.

(7) Washing after processing can be accomplished by means of a continuous flow of fresh water directly through the yarn. This continuous flow of fresh water insures quick and thorough cleansing of material.

(8)—Flexibility of capacity: Each unit will take care of a wide range in capacity. For instance, each tube will handle with equally good results from two to ten pounds, so that the standard seven tube machine will handle all lots from 15 to 75 pounds.

(9)—Ease of sampling, low labor costs and low installation and maintenance costs are other claims of the manufacturer.

The manufacturers state that this type machine is beyond the experimental or trial stage. It has been under development for a period of more than two years and for the past nine months has been in actual operation in a few selected mills where it has undergone every available test.

It is stated that combinations of yellow and blue, yellow and orange, olive and brown, violet and blue, etc., dye just as level as single colors. It is also stated that such colors as Anthrene Orange RRT, Anthrene Blue GCD, and Anthrene Brilliant Violet 2R are dyed on rayon, cotton or silk in a minimum of time and with perfect results.

The machine is also guaranteed for degumming of pure silk and the application of all the direct, acid and sulphur colors, as well as for chrome colors on wool and worsted yarn, and for all the acetate colors.

In commenting on the winding of yarn processed on this new machine, the manufacturers state that repeated tests have shown perfect winding results on such yarns as follows:

Tram Silk—2 to 12 thread low twist.

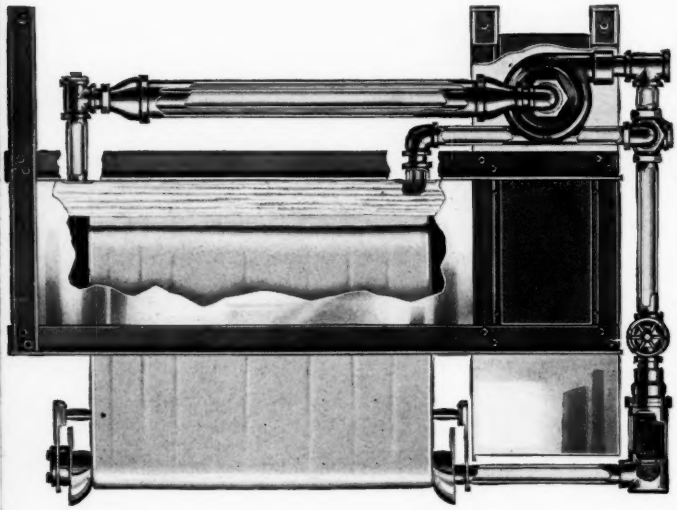
Grenadine twist up to 12 thread.

Rayon—75 denier to 300 denier from 24 to 50 filament from 2½ to 5 turns twist.

Acetate Yarns—A series of tests made on all deniers and filaments of acetate yarn have proven that any and all such yarns can be perfectly wound after processing.

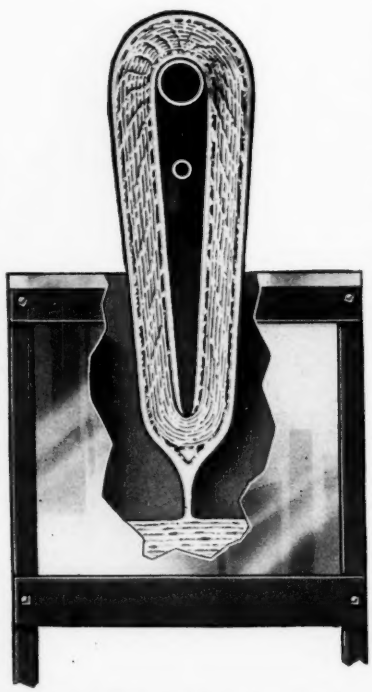
Cotton Yarn—80 single combed peeler gassed and mercerized to 3 ply 36 gassed and mercerized.

Wool and Worsted—From 60 single Botany worsted to coarse rug yarn.



Flow of liquor through system.

Perfect penetration and absolutely level dyeing has been obtained on such special yarns as rayon boucle, ratine and artificial horsehair.



End view illustrating skeins hung on tube.

Realizing that the claims of this new type machine are so unusual as to cause perhaps a doubt in the minds of experienced dyers and manufacturers, Smith, Drum & Company have established a complete dyeing department in their plant, where they will be glad to conduct tests for any interested parties in proof of their statements.

Printed matter illustrating and describing this machine can be obtained from Smith, Drum & Company, Philadelphia, the manufacturers.

Pontamine Fast Orange WS

The Dyestuffs Department of E. I. du Pont de Nemours & Company announces Pontamine Fast Orange WS, a direct dyestuff said to yield clear, rich shades of orange. It is redder and brighter than Pontamine Fast Orange S, and is characterized by its excellent solubility.

Pontamine Fast Orange WS is recommended by the manufacturer for the production of brilliant reddish orange shades on all types of cotton, rayon and pure silk. It is said to possess similar fastness to that obtained with Pontamine Fast Orange S, showing good resistance to light, acids, alkalies, water, perspiration, iron and rubbing, and fairly good fastness to washing.

Dyestuff Release

Supranol Brilliant Red 3 B is a new brand of the Supranol series offered by the General Dyestuff Corporation. It is dyed from a Glauber's salt-acetic acid bath and exhausted with formic acid. It produces on wool, bluish red shades said to have great brilliancy and very good fastness properties. The good fastness to light, washing and perspiration, excellent fastness to water and very good fastness to salt water, make Supranol Brilliant Red 3 B especially valuable for the dyeing of yarn for

General Dyestuff Corporation is sending out circulars on Brilliant Benzo Blue 6 B A Conc. which is manufactured by the General Aniline Works. It is said to be a very bright shade of greenish blue, well suited for dyeing cotton or rayon and also pure silk from an acetic acid bath. G-66.

Herman A. Metz Prizes

Four students of the Textile High School are being congratulated on having received the Herman A. Metz prizes for various activities related to dyeing.

The awards were presented as follows, at the high school commencement exercises: To Mary Guccione and Ruth Hirsch, the Herman A. Metz prizes for batik and dyeing; to James Alexander Mills and Louis Conti, the Herman A. Metz chemistry and dyeing awards.

Salesmen's Golf Outings

The second tournament of the Salesmen's Association of the American Chemical Industry will be held on July 22 at Lenox Hills Country Club, Farmingdale, L. I. The charge will be $5.00 for members and $7.00 for guests, including greens fees and prizes. Lunch and dinner can be paid for at the club. This outing will be under the direction of Thomas R. Farrell, Drug Markets, 101 West 31st St., New York., with whom entries must be filed by noon, July 21.

The place of the third meeting, August 18, will be at Dunwoodie Country Club, Yonkers, N. Y. The charge will be $5.00 for members, and $7.00 for guests, including greens fees and prize money. This tournament will be under direction of R. J. Grant, Noil Color & Chemical Co., 152 West 108th St., New York.

Union of The Dorr Company and Oliver United Filters, Inc.

John Van Nostrand Dorr and Edwin Letts Oliver have announced a union of the businesses and assets of the Dorr Company and Oliver United Filters, Inc. This union was brought about on June 1st by the formation of a new company, to be known as Dorr-Oliver Corporation, under the joint management of Messrs. Dorr and Oliver.

Dorr-Oliver Corporation will function through its two, wholly-owned operating units, a new Dorr Company, Inc., and a new Oliver United Filters, Inc. Mr. Dorr and Mr. Oliver will head their respective companies and with the aid of their present executive and technical staffs, will continue on behalf of Dorr-Oliver Corporation, the businesses which they have individually initiated, organized and expanded so successfully in the past.

The businesses of the two uniting companies are of long standing and complementary. The Dorr Company, occupies a leading position in the fields of agitation, classification and sedimentation through its equipment, built up around the original inventions of its founder, John V. N. Dorr; and the Oliver United Filters, Inc., occupies a similar position in the field of filtration through the inventions of Edwin L. Oliver and E. J. Sweetland. The union should, therefore, make it possible to offer to industry a more complete line of equipment and engineering service than either company could hope to offer individually.

The growth and success of the Dorr and the Oliver United businesses have been due, to a great extent, to constructive policies of constant development and research and a broadening of fields of usefulness in anticipation of the constantly changing needs of the basic industries which they serve. Their fields are related so closely from a technical standpoint, that the joint use of technical information and the carrying on of joint research and development is expected to result in more effective development of the equipment and processes which they have contributed to industry.

Both companies have built up technical staffs and manufacturing facilities at strategic locations throughout the world for the carrying on of their businesses which have grown to international proportions. The common use of these established facilities should give fuller, prompter and more efficient service to clients.

The two companies have frequently cooperated on the same projects, and, in many instances, the equipment of both is used at different stages of operation in the same plant. The founders of both companies have enjoyed a friendship extending over almost a quarter of a century and the long acquaintance of many members of the staffs has prepared them for effective cooperative effort.

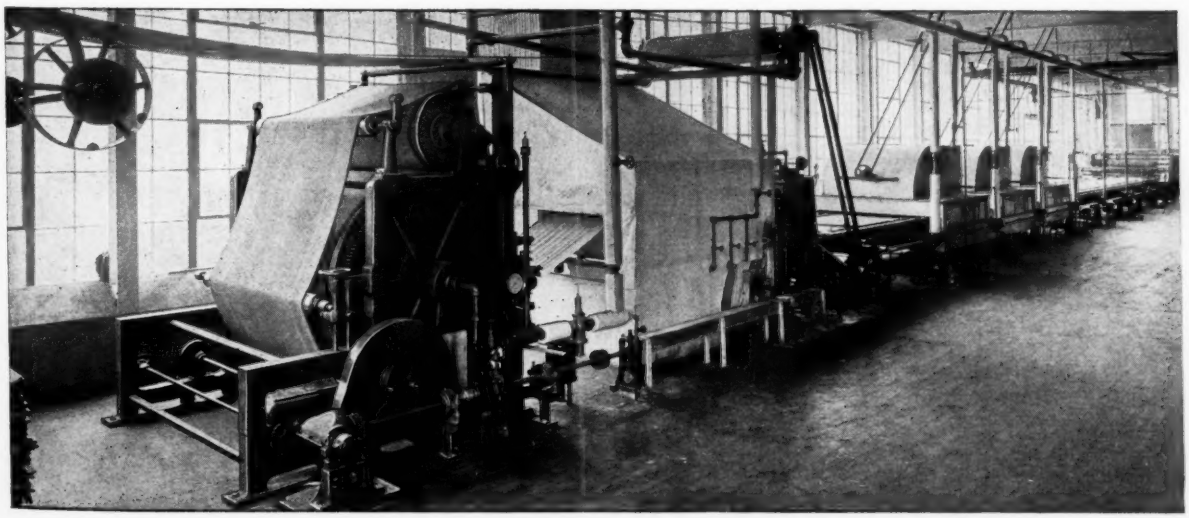
Under the union of interest now effected, there will be preserved to clients the close relations which they now enjoy with the respective staffs of the old organizations.

Butterworth Making Complete Sanforizing Units

Since H. W. Butterworth & Sons Co. have been licensed by Cluett, Peabody & Co., of Troy, N. Y., owners of patents on the sanforizing machine, which permits cloth to be shrunk to any pre-determined degree, they have built four of these complete sanforizing ranges, consisting of padding machine, pin chain tenter, atomizer, steamer, take-off pad, second atomizer, and steamer, compensator, ironer, blanket finishing machine, and folder.

In view of their long experience in the making of these various machines, and the fact that they make the sanforizing unit complete, immediately upon being licensed by Cluett, Peabody & Co., Butterworth received orders for the four machines.

Through the use of the sanforizing machines it is possible to bring fabrics down to any pre-determined shrink desired.



Delivery end of the Butterworth Sanforizing Unit, with the goods entering the blanket finishing cylinder after having gone through the various other operations, beginning with the padding machine. From the blanket finishing cylinder the goods travel to a folder, part of which is shown in the left foreground.

New Canadian Combine Represents Kalbfleisch

Announcement is made of the formation of Dillons-Klipstein, Limited, of Montreal, Canada. After July 1st this organization will act as sales representatives in the Canadian territory for the Kalbfleisch Corporation, in the sale of its products to the paper, textile and other industries.

The combination represents the business of Dillons, Limited, and A. Klipstein & Company, Ltd., of Canada.

Steam Trap

The C. J. Tagliabue Manufacturing Company of Brooklyn, N. Y., well-known manufacturers of recording and controlling instruments, are now offering to industrial users a new and unique steam trap.

There are several outstanding features of this new steam trap, the company reports, that emphasize its unusual economy in operation. The new and exclusive Differential Setting Feature makes it possible for the TAG Steam Trap to discharge condensate at a temperature corresponding to a uniform differential pressure from 0 to 20 lbs. below the operating steam pressure. If the trap is set to discharge condensate at a temperature corresponding to as much as 20 lbs. less than the operating steam pressure, it will discharge the condensate at this differential regardless of whether the steam pressure is 50 lbs., 75 lbs., or 125 lbs., and without any further adjustment of the Differential Setting.

General Release

Patent Blue V A is a new brand manufactured by the General Aniline Works and offered to the trade by the General Dyestuff Corporation, their sole selling agents. It is said to produce on wool, from a Glauber's salt Sulphuric acid bath, bright greenish blues.

Patent Blue V A is, according to the circular, very level dyeing and is especially recommended by the manufacturer for brightening combination shades for ladies' dress goods; it is said to meet the general fastness requirements for this purpose.

General Release

The General Dyestuff Corporation is bringing out a new product, Naphtol AS-LT, which represents a valuable addition to the naphtol series as it is said to produce with a number of the well-known developing agents, dyeings of very good fastness to light. The most important combination is Naphtol AS-LT-Fast Red Salt T R which produces a desirable red of Turkey red cast, claimed to possess very good fastness to light, excellent fastness to chlorine and very good fastness to caustic soda boiling.

Coupled with Fast Blue B B Base or Salt, the company states that it produces a rich shade of navy blue of very good fastness to light, excelling in the fastness to light dyeings produced on AS or AS-D grounds.

Martha A. Wilson, Nee Mercer

Mrs. Martha A. Wilson, a near relation of John Mercer, the discoverer of the mercerizing process, died June 14th in the Methodist Episcopal Hospital, Brooklyn, N. Y., after a short illness. The deceased lady is survived by her husband, Joseph A. Wilson, a former foreign representative of American Dye and Chemical firms, as well as five sons.

The rate for "Position Wanted" advertisements in this column is 2 cents a word—with a minimum of 50 cents per insertion. For all other types of advertisements—i.e., help wanted, machinery or supplies for sale—the rate is $5.00 per column inch or less per insertion.

POSITION WANTED

SALES EXECUTIVE, chemical training, member Chemical Societies, twelve years' experience in marketing, for past several years in charge distribution over wide areas, desires to locate in Eastern United States. Available September 1st. Interviews can be arranged after August 1st. Address Box 681, American Dyestuff Reporter, 440 Fourth Avenue, New York, N. Y.

POSITION WANTED

DYER—Six years' experience at bleaching and dyeing wool, cotton, jute and union raw stocks and yarns. Thoroughly experienced in all stages of carpet manufacture. Age, 26; married. Address: Classified Box No. 676, American Dyestuff Reporter, 440 Fourth Ave., New York, N. Y.

POSITION WANTED

Secretary-Stenographer, 8 years' experience with importing and domestic Chemical and Dyestuff manufacturing concern, desires a position in similar capacity. Address Classified Box No. 679, American Dyestuff Reporter, 440 Fourth Avenue, New York, N. Y.

POSITION WANTED

Fifteen years' experience in dyeing and printing piece goods. Formerly connected with three of the largest finishing plants in the industry. Will consider position as demonstrating salesman. Satisfactory references. Available July 15th. Box No. 678, American Dyestuff Reporter, 440 Fourth Avenue, N. Y. C.

WANTED

Wanted, practical dyer with experience on jigs, pad and continuous machines on direct sulphur and vat dyes. State age, experience, other details in first letter. Unusual opportunity. Box 682, American Dyestuff Reporter, 440 Fourth Avenue, New York, N. Y.